NDSIDE ACCESS TO U.S. PORTS

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Committee for Study on Landside Access to Ports

TRANSPORTATION RESEARCH BOARD
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Preface

In October 1990, the U.S. Department of Transportation (DOT) acting through the Maritime Administration (MARAD), sought assis tance from the Transportation Research Board (TRB) in identifying landside access problems and potential solutions for general cargo marine terminals in U.S. ports; the scope was subsequently expanded to include bulk terminals. To conduct the study TRB convened a 19 member committee; this committee was chosen according to National Research Council procedures, which require that membership include ppropriate areas of expertise and a balance of points of view.

STUDY SCOPE

The study committee was charged with examining impediments to landside access and evaluating and recommending appropriate strate gies to reduce those problems. As background information for the study, DOT provided case study reports on ports throughout the ountry athered by a DOT interagency study group for this purpose

The committee was asked to determine whether access to the ports examined is hindered by lack of interagency and public-private coordination, physical impediments, land use restrictions, or federal, state, and local safety and environmental regulations. The committee was also asked to evaluate the severity of the problems identified and, as appropriate, to recommend remedial strategies.

The case study reports and the survey data supplied to the committee by the study sponsor provide a useful initial assessment of the scope of landside access problems. They represent the views of port officials and, to a lesser extent, users of the ports, but they are not a substitute for the detailed engineering and economic studies that would be required to analyze the specific problems and solutions at an individual port. Each port faces a different set of problems and can draw on a different set of resources in dealing with them. Although each port is unique, almost all ports share a common predicament: many different groups, agencies, and levels of government can affect landside access, but they have competing objectives. This report turns on two key conclusions. First, most local port communities and their local and state governments have a strong incentive to resolve the differences of the groups affecting landside access; in the past this self-interest has served the national interest by providing adequate capacity for the movement of interstate cargo. Second, the committee believes that the federal government's role in addressing landside access problems should be one of providing incentives to state and local governments to ensure that concerns about interstate and international commerce and national security are adequately considered when priorities are set for funding transportation facilities. The committee's conclusions depend on the exercise of judgment rather than the analysis of empirical information. Its consensus on these matters emerged over the course of several meetings in which the problems faced by port officials were weighed alongside the concerns and priorities of neighborhood groups, environmentalists, and officials in other agencies, private firms, and levels of government.

contributions, as did liaison representatives from different agencies o
DOT, the American Association of State Highway and Transporta
tion Officials, the American Association of Port Authorities, Inlanc
Rivers Ports and Terminals, Inc., and the Pacific Northwest Water
ways Association.

The study was conducted under the overall supervision of Rober
E. Skinner, Jr., Director of Studies and Information Services for th
Transportation Research Board. Stephen R. Godwin served as study
director and drafted the report under the supervision of the commit
tee. Christina Casgar, Senior Program Officer, helped conduct th
study. Draft material prepared by Douglas L. Johnson and Eric W
Beshers, consultants to TRB, appear in various parts of the report
Thomas M. Corsi wrote Appendix B. Wendy Chalem and Jennife
Bartlett of Vickerman-Zachary-Miller prepared Figures 1, 2, and 3
The final report was prepared for publication under the supervisio
of Nancy A. Ackerman, Director, TRB Reports and Editorial Ser
vices, and Susan E. G. Brown, Assistant Editor, served as the edito
of the report. Frances E. Holland and Marguerite Schneider provide
word processing support and assisted in meeting logistics.

Contents

Executive Summary

The American economy depends more and more on producers and consumers all over the world. Over the past 20 years imports and exports have increased so that they equal one-fifth of the U.S. gross national product. U.S. seaports handled $450 billion in international cargo in 1990. These ports have become critical transfer points in the intermodal network that moves the nation's international cargo (Figures ES-1, ES-2, and ES-3).

The efficiency of this intermodal connection could be threatened however, by increased bottlenecks in the landside transportation system serving the ports. For some ports the weakest link in the logistics chain is at their back door, where congested roads or inadequate rail linkages to marine terminals, and sometimes both, cause delays and raise transportation costs. Half of the country's ports already face growing congestion on the access routes serving their terminals, and total port commerce is projected to triple over the next three decades. It is unlikely that existing access routes will be able to accommodate

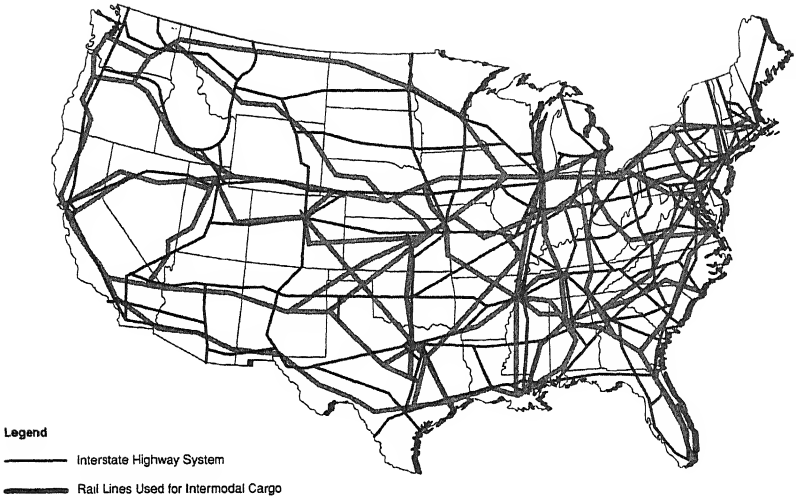
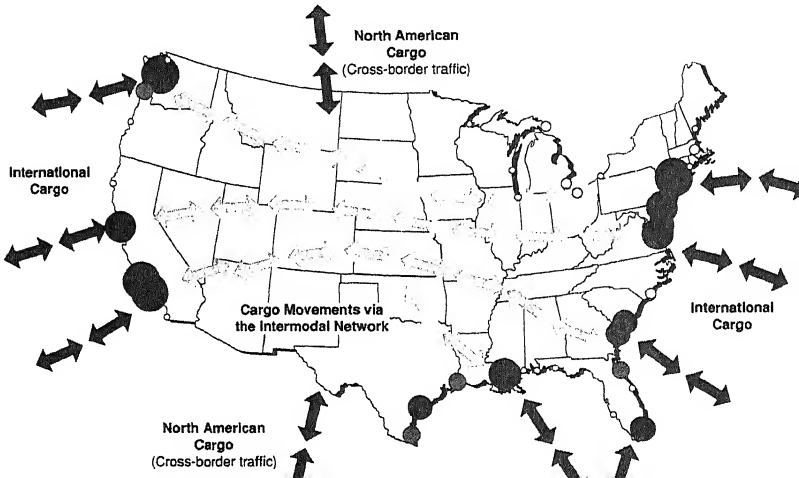


FIGURE ES-1 Intermodal cargo network of United States.



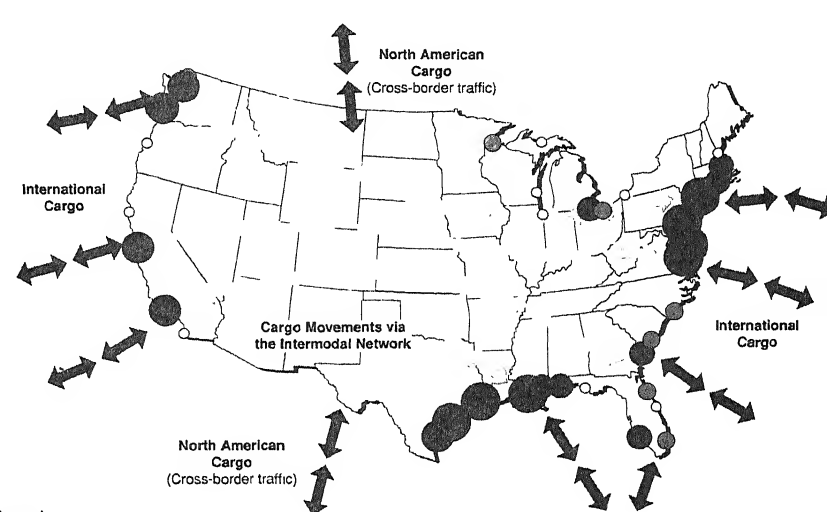


FIGURE ES-3 Oceanborne foreign trade by port region, 1990, in long tons.

aftermath of the war in the Persian Gulf, the U.S. military plans to rely even more heavily on public ports and private carriers for future deployments of troops and material.

EXAMPLES OF LANDSIDE ACCESS PROBLEMS

A 1991 survey of port officials by the American Association of Port Authorities (AAPA) provides a useful assessment of the ways in which port officials view their landside access problems. The survey was sent to the 85 public member ports of AAPA, 54 of which returned completed questionnaires. The overall response rate was 65 percent. The respondents account for 65 percent of the total tonnage and 87 percent of the value of all exports and imports handled by U.S. ports in 1990. The survey identifies infrastructure

Half of all ports, and nearly two-thirds of container ports, face growing traffic congestion of the major truck routes that serve their terminals.

Infrastructure Impediments

Among the infrastructure inadequacies faced by port officials, two problems stand out. The survey results indicate that half of all ports, and nearly two-thirds of container ports, face growing traffic congestion on the major truck routes that serve their terminals (Table ES-1). Such congestion increases transport costs and vehicular emissions that degrade air quality. Almost half of the ports report that the rail lines serving their terminals have many at-grade crossings of local streets (Table ES-1). As a result, long, highly efficient trains that serve the ports can tie up traffic on local streets.

Besides these infrastructure problems, about one-third of container ports responding to the survey do not have bridge or tunnel clearances sufficient to accommodate the most productive double-stack trains (Table ES-1).

TABLE ES-1 Examples of Landside Access Impediments Identified in AAPA Survey

Impediment	Container Ports ($n = 25$) No.	Percent	All Ports ($n = 54$) No.	Percent
Truck routes usually or always congested	16	64	27	50
Numerous at-grade rail-highway crossings	14	56	25	46
Inadequate clearances for high-cube double stacks	9	36	12	22
Competition increasing for available land	21	84	40	74
Restricted access improvements due to lack of land	11	44	17	31
Regulations in place or proposed restrict truck or rail operations	4	16	5	11
Development of access improvements impeded by wetland regulations				
Usually or always	6	24	11	20
Sometimes	8	32	16	30
State DOT coordination with port				
Usually or always	10	40	22	41
Sometimes	9	36	13	24
Rarely or never	5	24	10	20

The ability to correct these problems, however, is often beyond the reach of port officials. As described in the next few sections, physical, land use, environmental, and institutional impediments make difficult the resolution of these problems. In addition, the authority for making improvements often resides with local, state, and federal transportation agencies rather than with the ports themselves. Such projects must compete with many other demands for funds, and they are not always rated as high as other local priorities.

Rail service on or adjacent to marine terminals reduces truck traffic on urban streets but consumes scarce urban waterfront land (*photograph courtesy Port of Tacoma*).

provide for rail service that is on or adjacent to the marine terminal; this would reduce the need for trucks to move containers from marine to rail terminals by way of urban streets. This option, however, is suitable for containers to be moved more than 500 mi from the port, instead of for those destined for the local market. When terminals need to be reconfigured to provide this efficiency gain, waterfront land is required. Most ports are in major metropolitan areas, where commercial development of urban waterfronts is increasing the competition for available land. Commercial development of waterfront land can earn far more revenue for local governments than can most maritime uses. It is not surprising that three-fourths of the port officials surveyed report that competition is increasing for available wa-

terfront land. Port officials also report that lack of land has already restricted access improvements at one-third of ports (Table ES-1).

Many ports encounter resistance to their efforts to improve terminal operations from residents of adjacent residential areas and from homeowners along the major landside corridors serving the ports. A few ports (11 percent) report that proposed or existing regulations are designed to restrict the hours of operation on rail or truck corridors serving their terminals (Table ES-1). Similar proposals are being considered by many other port cities. Some ports have avoided making landside improvements that would result in greater traffic because of neighborhood opposition.

Environmental Impediments

Environmental regulations, particularly those applying to wetlands, also restrict the ability of seaports to reconfigure their terminals and improve their landside access routes. One-fifth of port officials responding to the survey report that wetlands regulations usually or always impede development of access improvements, and one-third report that they sometimes impede development (Table ES-1). In the past the ports could use dredged materials to fill waterfront land and provide more space for terminal development, but this option has been greatly reduced by federal and state policies to protect wetlands from further development.

Although the aforementioned restrictions on access corridor hours of operation probably resulted from neighborhood opposition to noise and traffic in the past, concerns about air quality are more likely to produce such restrictions in the future. For example, proposals are being advanced to reduce truck hours of operation during peak periods in Los Angeles, home of one the largest container ports in the country. Many ports could face similar restrictions in the future as their metropolitan areas attempt to meet federal and state air-quality standards.

as governmental enterprises somewhat removed from traditional governmental agencies. Local and state transportation agencies are the most important governmental authorities with which ports must work to resolve their landside access problems, and the coordination between ports and these agencies is not as good as it could be. Whereas 41 percent of ports report that their state transportation agencies usually coordinate activities such as road construction with them, 24 percent report that their states only sometimes coordinate with them, and 20 percent report that their states rarely or never do so (Table ES-1). Revisions to federal surface transportation programs contained in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 have placed even more authority in the hands of state and local officials, which heightens the need to improve coordination to ensure that national needs such as interstate and international commerce are given full consideration when local authorities allocate available transportation funds.

Local Versus National Interest

Most port officials report problems with growing traffic congestion, traffic conflicts between automobiles and trucks and trains serving the ports, or increased competition for land, but the severity of these problems varies from port to port. The individual ports are sufficiently different that no single problem can be said to have the same priority everywhere—one port may be more constrained by neighborhood opposition, another by environmental restrictions, and another by geography. In addition, the opportunities to respond to the individual problems vary with the leadership abilities of individual port directors, their relations with local and state transportation and environmental agencies, state and local laws and regulations, and the ever-shifting demands of shippers and carriers as they seek greater efficiency in serving their customers.

The major national policy issue raised by the landside access impediments described earlier is the extent to whi h l ca g e m s

consumers and producers dispersed throughout the nation. This raises the concern that pressures placed on local authorities by commercial urban land developers, neighborhoods, and local environmental groups will result in future investment decisions in which national priorities are not considered or given enough weight.

The study committee believes that there are many opportunities to better ensure that local and national needs are balanced in the efforts to address seaport landside access problems. These opportunities are, for the most part, designed to improve communication among the various units of government involved in the landside access needs and problems of seaports. Lack of communication among the various public and private agencies involved in landside access is a major problem. As with many other complex policy issues, no single agency has complete authority, and different agencies pursue different, sometimes competing, objectives. Even among transportation agencies, officials at different levels of government often have different priorities. These differences are magnified when the goals and objectives of environmental agencies and environmentalists and the interests of private carriers and neighborhood groups are included.

Implicit in the choice of the opportunities listed in the following is the recognition that most ports and their surrounding communities are engaged in intense competition for cargo. This competition has served the national interest by fostering innovation and cost control by ports. In addition, in the competition for freight, most ports and their state and local governments have long been willing to invest state and local funds. Although this competition can lead and has led to excess investment when individual communities invest in port facilities on a speculative basis, it has also stimulated local governments to provide for the transportation needs of ports. As a result, the committee believes that more direct federal intervention in local and state decision-making to solve local access problems is not warranted at this stage. A more aggressive federal response is not appropriate in part because of the complexities of the competing interests, and because the decentralized, competitive transportation system has provided adequate capacity for the movement of interstate and

noise and congestion. They must adhere to multiple federal and state mandates to protect the environment. They must answer to pressure from their own constituents to develop urban waterfronts to beautify their cities and increase local tax revenues. And they must consider their own economic interest in preserving and investing in maritime industries. These goals often conflict and require trade-offs. Some local governments may well decide that their maritime industries are a lesser priority, but so far most state and local jurisdictions have shown a willingness to invest heavily in their ports.

Given the competing interests involved in this issue and the benefits of competition among port communities, the committee concludes that the most appropriate public policy responses are to (a) provide incentives to state and local governments to ensure that port access needs are fairly and thoroughly considered alongside other competing demands, (b) encourage better long-range planning at the regional or metropolitan level, and (c) allow for a variety of options for ports to pursue that are suited to the unique situations in each port region. Specific examples of these options are identified in the following sections: the first summarizes opportunities created by the ISTEA, and the second summarizes additional opportunities for public officials.

RECOMMENDATIONS IN ISTEA TO RESOLVE ACCESS PROBLEMS

The 6-year reauthorization of the federal surface transportation programs in the ISTEA includes a variety of new opportunities for responding to port landside access problems. The specific provisions of the ISTEA as they apply to each level of government are mentioned briefly in the following section and discussed in the report itself in greater detail. Although the ISTEA creates new opportunities at all levels of government, actions to be made at the state and local levels are the most pressing.

States and Metropolitan Planning Organizations

For metropolitan areas of 200,000 or more persons, the ISTEA re-

tal plans and select projects with the assistance of their states. For metropolitan areas with fewer than 200,000 persons, the states are to evelop capital plans with the assistance of their MPOs. Among the factors to be considered in the development of these capital plans are access to ports, intermodal transportation facilities, preservation of rights-of-way for future transportation projects, and methods to enhance the efficient movement of freight. States are also given new lanning mandates to develop management systems in six areas, which include traffic congestion and intermodal transportation facilities and systems. These new requirements create new opportunities for addressing port access problems.

State and local governments as well as port officials can take several steps to facilitate landside access to maritime industries. *As required by the ISTEA, freight transportation needs should be given more detailed consideration when routes are designated as eligible for federal and state assistance and in assigning priorities for funding.* This recommendation should be applied immediately in the identification of routes eligible for the National Highway System, which is to include the Interstates and other major primary highways. This system, which is to be funded at the highest level, is to be defined by the Federal Highway Administration (FHWA) with the assistance of the states and MPOs and presented to Congress by December 1993. *States and MPOs should also include freight transportation facilities in the development of their intermodal transportation facility plans (Chapter 7).*

States and MPOs are also required by the ISTEA to develop congestion management plans that are to be used to guide future investment decisions. Local and state governments could use congestion management techniques and require greater private investment to make sure that development on access routes serving port terminals does not result in undue congestion. *The committee recommends that congestion management techniques to maintain efficient freight movements on port access routes be incorporated into congestion management plans (Chapter 4).*

As commercial and residential development encroach on port com-

that MPOs encourage the preservation of rights-of-way, potential transportation corridors, and waterfront land in their long-range planning (Chapter 4).

Ports

Because of the ISTEA's new emphasis on MPOs for planning and decision making, combined with statewide intermodal planning requirements, port officials should become much more involved in the planning activities of their MPOs and state transportation departments. The act indicates that MPOs should include elected officials, appropriate state officials, and officials of local transportation agencies. This indicates that port officials can be directly involved in their MPOs, as they already are in some states and metropolitan areas. For example, to secure the consideration of freight transportation needs, Washington State recently required MPOs to include a port official on their boards. *Port officials should seize these opportunities to ensure that (a) their access routes are considered for inclusion in the designation of the National Highway System and (b) their MPOs conform to the intermodal freight transportation planning requirements of the ISTEA, which include providing for port access routes. As state and local officials grapple with the intermodal requirements of the ISTEA, port officials should take the initiative to ensure that intermodal freight transportation needs are included (Chapter 7).*

Given the importance of and popular support for environmental protection, ports and local governments find themselves more accountable for the goal of protecting the environment when improving landside access. The federal government has provided additional assistance in meeting environmental goals. The ISTEA makes explicit allowance for the use of transportation funds for acquiring, restoring, and enhancing wetlands. *Port officials should be aware of and apply for using such funds to compensate for the environmental effects of improving port access facilities (Chapter 5).*

Federal

In addition to requiring the development of the National Highway System, the ISTEA charges the Secretary of Transportation with coor-

dinating federal policy on intermodal transportation and initiating policies to promote efficient intermodal transportation in the United States. The Secretary can call on various offices and agencies of the U.S. Department of Transportation (DOT) to carry out these responsibilities.

Federal Highway Administration

In developing regulations and in carrying out the provisions of the ISTEA, FHWA will play a key role in determining whether the spirit of the ISTEA is realized. The first opportunity to address port access problems will be in the designation of the National Highway System. *FHWA should ensure that port access routes important to interstate and international commerce and national security are included in the development of this system.*

One of the basic engineering criteria that FHWA uses in determining project eligibility for federal aid is the number of vehicles expected to use a facility. Many port access routes generate substantial truck traffic but may not carry the large number of passenger vehicles characteristic of federal-aid routes. *Rather than simply rely on traffic counts in determining the eligibility of a route for federal aid, FHWA should develop criteria based on the importance of routes for interstate commerce and national competitiveness and a favorable benefit-cost ratio (Chapter 7).*

Some ideas for responding to port access problems are not conventional highway projects but could be funded in part from the Highway Trust Fund. Ports are already pursuing a variety of strategies for resolving their access problems:

- Dedicated freight corridors between terminals and major rail and highway connections are being planned by several major ports; these corridors could divert truck traffic from local streets and thereby reduce congestion and neighborhood opposition;
- More use of on- or near-terminal rail service could also reduce truck traffic on local streets;
- The development of intermodal terminals many miles inland o

The success of the first three of these efforts will partly depend on reducing the congestion caused by at-grade rail-highway crossings. Although the ISTEA does not mention these issues explicitly, it clearly encourages greater reliance on the existing intermodal transportation system for moving people and freight. The ISTEA also encourages more reliance on toll facilities and is much more permissive about the uses of toll revenues than previous legislation. Use of such revenues to develop intermodal facilities such as barge terminals could help reduce truck traffic on already-congested roadways. *The committee recommends that FHWA recognize the spirit of intermodalism and flexibility for states in the ISTEA in approving project proposals such as those listed here (Chapter 3).*

Office of Intermodalism

The ISTEA mandates creation of the Office of Intermodalism in the Office of the Secretary. This office will be responsible for collecting intermodal data and for coordinating federal research on intermodal transportation. In regard to intermodal data, this committee's efforts to analyze bottlenecks on port landside access routes revealed the inadequacy of such information. Similarly, a 1992 TRB report, *Data for Decisions*, found that the major gap in DOT data collection is data on the origin, destination, and mode of freight flows. It also noted that data collection is a low-profile activity in the federal government, one without many champions. *The committee recommends that the Office of Intermodalism advocate the importance of intermodal freight transportation and that it strongly encourage the new Bureau of Transportation Statistics in DOT to make its highest priority the redressing of serious shortcomings in intermodal freight flow data (Chapter 7).*

In its role as the coordinator of intermodal research, the Office of Intermodalism should ensure that federal research is conducted on topics related to efficient freight flow to and through port complexes. For example, research on improving and harmonizing information systems and technology could help overcome some of the bottlenecks

MPOs, and states in defining a research agenda that will help them address the issues they face. *The federal government should serve as a catalyst to bring together the various parties involved in the use of technologies such as information systems in order to define joint needs, to promote standardization, and to encourage research on and dissemination of innovations in cargo handling and intermodal freight transportation (Chapter 8).*

As the ISTEA shifts the locus of decision making toward states and MPOs, it remains important for the federal government to communicate the national interest in routes that are critical for moving interstate and international commerce. *The committee recommends that the Office of Intermodalism make certain that studies are conducted periodically on the port access routes important to interstate and international commerce and national defense and that this information be conveyed to state and local officials responsible for funding decisions and to all parties concerned about the improvement of these routes (Chapter 7).*

Policy research is also needed at the federal level. For example, the committee examined a proposal for establishing a national port landside access trust fund supported by revenues earned from a fee imposed on cargo moving through the port complex. A national requirement would improve the ability of ports to charge a landside access fee, the revenues of which would be used to provide the local matching funds to federal transportation aid. Although appealing in concept, potential difficulties require additional study and analysis to determine if they could be resolved, and doing so was beyond the resources of this committee. *The Office of Intermodalism should ensure that a study is carried out on the feasibility of the proposal for a landside access trust fund (Chapter 7).*

The ISTEA also calls for the creation of a National Commission on Intermodal Transportation, which will study the status and problems of intermodal transportation and recommend resources needed to correct these problems. The findings of this report and the foregoing recommendations would also apply to this commission.

To ensure that state and local governments consider the
between major highways and ports that are important fo
security and defense, *the federal government should requir*
at the departments of Transportation and Defense to co
periodic identification of corridors that may be needed f
ments of troops or military hardware and ammunition. In
the committee recommends that Congress consider allowi
fense Department to provide the local share of funding for
tation projects that are of military significance but that
priority for local governments (Chapter 6). If this provi
incorporated into law, however, specific criteria for milita
cance would need to be included to keep this provision fro
ing a vehicle for congressionally funded demonstration proj

The U.S. Army Corps of Engineers could do more to e
environmental goals are met without overly burdening a
Permits for responding to common areawide problems (ref
special area management plans and regional permits) shoul
on more extensively by the Corps of Engineers; this con
even be extended to cover common problems in a harbor (C

States and MPOs

Lack of funds for the local share of port access projects is
reasons that such projects fail to advance in state capital pla
make it onto the capital plan at all. Multimodal trust funds
states such as Maryland and Louisiana give state transporta
cies more flexibility to respond to intermodal transporta
lems. The successes in providing for excellent port access at
and the recently funded access corridor for the Port of New
attributable in part to having a dedicated source of state
meeting these needs. *The committee recommends that state*
establishing multimodal transportation trust funds in ora
vide a funding source for port access needs (Chapter 7).

Regional planning, such as that practiced in the San Fra
Area, has brought together environmental and transporta
and tried to balance the inherent conflicts between them.
the Bay Area planning process has not pleased all port offic

made progress toward the goal of ensuring greater certainty in getting state permits for port development plans, has avoided investment in redundant port facilities, and has made sure that port access needs receive priority in the metropolitan transportation planning agency's short- and long-range capital plans. *The committee recommends that MPOs consider both development and environmental needs in port regions when analyzing port access needs. The ability to exercise these opportunities may require specific state action to enable and empower regional planning organizations to develop and implement regional plans; where required, states should grant such authority (Chapter 5).*

States such as Massachusetts and California have developed more stringent state and local zoning ordinances that have been used to protect maritime uses on waterfront land. *The committee recommends that states, coastal zone management agencies, and local governments develop similar zoning regulations and ordinances where appropriate (Chapter 4).*

Ports

Many cities developed around their ports. As these cities have grown and diversified their economic bases, the contributions of ports to the local and regional economy may have become less apparent. *Port officials should be actively educating local elected officials and commercial, neighborhood, and environmental groups about the transportation needs of ports, the roles ports play in moving international commerce and providing for national defense, and the economic benefits ports give to their cities and regions (Chapter 7).*

Port development plans and transportation needs in urbanized areas often conflict with the interests of neighborhood groups opposed to traffic noise and congestion. Groups concerned with protecting the neighborhood, environmental, and historical qualities of their communities have become much more involved in local planning. Because of the power that local governments have over zoning

cause by working more closely with neighborhood group planning officials while they are planning their improven velop and negotiate projects more acceptable to all parties avoid litigation by groups opposed to such projects (Chap

Besides coordinating more with their MPOs, ports i region should cooperate more with each other to help adverse environmental impact of port projects. *The com ommends port cooperation for mitigation planning on a harborwide basis, including planning for mitigation ba restoration or enhancement of a wetland before developn obtain and fulfill permit requirements (Chapter 5).*

Terminal operators and users of port facilities can also steps to help reduce the bottlenecks at terminal gates ar demands placed upon marine terminals and their access *committee recommends that terminal operators, users, an resentatives collaborate to find ways to increase the hours operations at an affordable cost, coordinate schedules t traffic conflicts, and alter ship-loading schedules to mi minute peak demands on terminal facilities. Ship lines a operators should also streamline equipment interchange automate paper work, and apply information-based tech increase the efficiency of terminal use and reduce peak d the surface transportation system (Chapter 8).*

1

Introduction

The growing competition in international markets has increased the dependence of producers in the United States on an extensive and efficient transportation system. The individual modes of the nation's transportation system have responded well to the demands of international trade, but bottlenecks to efficient freight movement occur at the points at which freight moves from one mode to another. In particular, growing congestion on landside access routes to ports could threaten the efficiency of the system.

To study the adequacy of rail and highway access to American ports, the U.S. Department of Transportation (DOT) formed a study group in 1990 that includes the maritime, rail, highway, transit, and research and special program agencies of DOT as well as four trade associations: the American Association of Port Authorities (AAPA), the American Association of State Highway and Transportation Officials (AASHTO), Inland Rivers Ports and Terminals, Inc. (IRPT), and the Pacific Northwest Waterways Association (PNWA). Acting through the Maritime Administration (MARAD), DOT also sought

terminal design, urban planning, and state government.

INFORMATION SOURCES

As background material for the study committee, AAPA su
membership about landside impediments, AASHTO requ
individual state DOTs respond to landside access problem
and IRPT and PNWA assisted in a survey of their members
ports and terminals. In addition, the DOT interagency s
prepared reports on its visits to several ports around the co
results of the surveys, summaries of the site visits, and re
state DOTs were given to the study committee. Several m
the committee also participated in a 1991 workshop spo
DOT in which industry and government officials from a
country discussed problems with port landside access (U
bors Institute 1992).

At each port the DOT study team met with port and
officials, as well as with port users. They also held publi
during which individuals were invited to express their conc
landside access. Materials describing the ports and the pro
face were summarized and given to the committee, as we
ries of the public hearings. (MARAD is preparing a sep
mary for public distribution that includes the trip reports.)

Survey of U.S. Ports

In the chapters that follow, the committee draws on a su
member ports of AAPA. Of 85 public ports in AAPA, 54 re
the questionnaire, resulting in an overall response rate of
The complete list of respondents is given in the text box
locations are shown in Figure 1–1. The survey and the res
provided in Appendix A.

The respondents to the AAPA survey range in size from
ports in the United States to ports that had relatively litt
1990 (Table 1–1). Almost all the nation's general cargo
included. (General cargo usually refers to manufactured
cessed goods, with the exception of automobiles and lu

FIGURE 1-1 Ports that responded to AAPA survey.

cause most general cargo now moves by container, and because almost all general cargo will move by container within the next two decades, the discussion and tables in this report feature the 25 general cargo ports in the survey that currently handle more than 90 percent of container movements. The ports in the survey that moved 30,000 or more containers in 1990 are included in the subsequent analyses of container ports. All but one of the container ports in the United States that meet this criterion responded to the AAPA survey; hence, the results can be assumed to be accurate in depicting the ways in which officials at container ports view their access problems.

Many of the ports included in the container port classification are also major bulk and neo-bulk commodity ports (Table 1–1). (Bulk cargo refers to liquid and dry commodities moved in ship-load lots such as petroleum products, coal, and grain. The term "neo-bulk" is often used for commodities such as automobiles and lumber.) The

Respondents to AAPA Survey on Landside Access

Baltimore, Md.*
Baton Rouge, La.
Beaumont, Tex.
Boston, Mass.*
Brownsville, Tex.
Canaveral, Fla.
Charleston, S.C.*
Cleveland, Ohio
Corpus Christi, Tex.
Detroit, Mich.
Duluth, Minn.
Eastport, Maine
Everett, Wash.
Everglades, Fla.*
Freeport, Tex.*
Galveston, Tex.*
Gulfport, Miss.*
Hampton Roads, Va.*
Honolulu, Hawaii
Houston, Tex.*
Indiana Port Commission
(Burns International,
Clark, and Southwind)
Jacksonville, Fla.*
Kalama, Wash.
Lake Charles, La.
Long Beach, Calif.*
Longview, Was
Los Angeles, C
Manatee, Fla.
Miami, Fla.*
Milwaukee, Wi
New Orleans, I
New York/Nev
Oakland, Calif
Olympia, Wash
Pascagoula, Mi
Pensacola, Fla.
Philadelphia, P
Port Arthur, Te
Portland, Main
Portland, Oreg
Portsmouth, N
Richmond, Va.
San Diego, Cal
San Francisco,
Savannah, Ga.
Searsport, Mai
Seattle, Wash.*
Stockton, Calif
Tacoma, Wash.
Tampa, Fla.
Wilmington, D
Wilmington, N

*Ports with more than 30,000 annual 20-ft equivalent units are included in the analy
container ports discussed in the text.

other than general cargo. Most ports are an agglomeratio
ent marine terminals. Some terminals specialize in bulk co
others in general cargo. The terminals may be contiguou
are often in different parts of a harbor area. The highwa

ceanborne Foreign Trade Handled by Ports in AAPA Survey, by Type of Service, Ranked by Total Value

	Long Tons in 1990				Value
	Liner[a]	Tanker[b]	Tramp[c]	Total	($millions)
	10,560,629	4,515,870	6,422,844	21,499,343	56,334.9
w Jersey	11,264,420	29,922,102	5,569,909	46,756,431	49,575.8
	9,239,961	2,061,773	8,601,317	19,903,051	42,858.0
ds	5,239,282	4,343,034	53,376,402	62,958,718	39,574.3
	6,931,492	223,480	4,313,570	11,468,542	26,737.7
	3,713,174	466,146	10,247,071	14,426,391	24,304.4
	5,281,968	199,268	678,096	6,159,332	17,244.2
	3,177,080	2,381,240	16,706,885	22,265,205	16,583.3
r/Pennsylvania	1,886,982	34,635,215	4,391,493	40,913,690	14,672.2
	5,570,061	258,310	2,170,157	7,998,528	14,315.5
	3,573,631	12,717,293	26,997,952	43,288,876	11,730.3
	3,627,626	1,758,270	4,289,400	9,675,296	9,955.8
	2,181,216	164,650	613,010	2,958,876	7,678.3
.)	1,741,209	503,968	12,224,502	14,469,679	6,576.0
	1,113,652	1,976,478	3,441,768	6,531,898	6,445.5
	509,749	10,441,093	1,030,020	11,980,862	4,788.5
	523,196	14,169,064	16,448,650	31,140,910	4,570.0
	1,151,224	1,702,679	971,910	3,825,813	4,421.4
	112,448	24,158,191	7,731,912	32,002,551	4,389.7
el.)	294,829	7,474,643	2,020,429	9,789,901	3,392.7
.C.)	840,761	1,001,369	1,076,693	2,918,823	3,250.2
	367,548	17,655,899	3,686,993	21,710,440	3,142.0

continued)

Long Tons in 1990				Value
Liner[a]	Tanker[b]	Tramp[c]	Total	($millions)
1,103,473	372,464	221,167	1,697,104	2,982.1
207,390	15,716,891	2,063,006	17,987,287	2,887.5
481,612	3,217,110	15,500,295	19,199,017	2,525.9
608,244	1,506,505	2,821,362	4,936,111	2,349.6
307,083	12,531,164	1,673,338	14,511,585	2,091.2
363,691	304,875	4,332,580	5,001,146	2,004.5
267,506	193	179,202	446,901	1,683.7
199,852	5,781,046	400,850	6,381,748	1,413.1
331,696	3,666,852	446,724	4,445,272	1,201.1
105,865	5,280,679	1,602,292	6,988,836	1,159.2
346,975	7,881	5,727,883	6,082,739	1,107.6
440	97,475	5,475,417		

	824	315,093	1,070,118	1,386,035	364.2
	15,675	0	2,121,056	2,136,731	323.3
	63,803	130,226	2,932,708	3,126,737	322.1
	75,654	162,937	456,508	695,099	208.5
	72,138	11,976	1,598,870	1,682,984	168.9
	47,467	82,138	540,211	669,816	146.6
	4,663	0	725,076	729,739	143.3
	10,621	199,205	176,726	386,552	124.7
	144,210	22,629	159,922	326,761	112.5
	96,304	0	121,674	217,978	89.9
	11,434	476,124	144,588	632,146	86.1
	62,735	0	388,845	451,580	78.3
Commission					
ne)					
	84,372,009	224,387,560	246,797,352	555,556,921	398,007.0

ot available for last two entries.
vice, mostly containerized general cargo.
d bulk cargo.
ervice, mostly dry bulk but includes shipload lots of general cargos or neo-bulk, for example, lumber.

did not respond); these ports move a large share of bulk commodities. According to data provided by MARAD on international waterborne commerce handled at U.S. ports, the total tonnage reported for the ports that responded to the AAPA survey shown in Table 1–1 represents about 63 percent of total U.S. import and export tonnage in 1990; the value of this freight accounts for 87 percent of all U.S. imports and exports in 1990.

The AAPA surveys only represent the views of port officials. The views of state transportation officials, private carriers, environmentalists, and neighborhood groups are not equally represented. The study committee, however, includes individuals with expertise in state and local transportation administration, public policy, private transportation, shipping, environmental regulation, and the role of neighborhood groups in urban planning. In this report the committee has attempted to balance the landside access problems that ports face with issues such as the concerns of neighborhood groups, the public support of policies to protect the environment, and the complex intergovernmental relationships and policies that govern the provision of transportation facilities.

In addition to discussing port landside access problems in the larger context in which they occur, the committee has also interpreted the survey results in a conservative manner. Ambiguous survey questions and answers in the AAPA survey were not used. A discussion of some of the limitations to the survey is provided in Appendix A, which also contains the entire questionnaire and a summary of the responses.

Case Studies

To help the study committee understand the landside access problems facing ports around the country, DOT prepared reports on each of the site visits (see text box). Although not meant to be a representative sample, all coastal regions of the 48 contiguous states were visited (East, Gulf, and West Coasts and the Great Lakes). According to data supplied by MARAD on international water-

Ports and Port Authorities Visited by DOT Study Teams

Boston, Mass.
Charleston, S.C.
Chicago, Ill.
Delaware River ports (Philadelphia, Chester, and Marcus Hook, Pa.; Camden, Glouster, Pennsauken, and Paulsboro, N.J.; and Wilmington, Del.)
Galveston Bay ports (Galveston, Houston, Port Arthur, Beaumont, and Texas City, Tex.)
Hampton Roads, Va.
Long Beach, Calif.
Los Angeles, Calif.
Memphis, Tenn.
New Orleans, La.
New York and New Jersey
San Francisco Bay Area ports (Oakland, Richmond, Sacramento, San Francisco, and Stockton, Calif.)
Seattle, Wash.
St. Louis, Mo.
Tacoma, Wash.
Toledo, Ohio

The case study reports and the survey data provide a useful initial assessment of the scope of landside access problems. They represent the perceptions of port officials and, to a lesser extent, users of the ports, but they should not be viewed as a substitute for the detailed engineering and economic studies that would be required to analyze the specific problems and solutions to them at any individual port.

Survey of Inland Bulk Terminals

To provide some insight into landside access problems faced by terminal operators on the major river systems that are relied on for the movement of bulk commodities, IRPT and PNWA assisted in a survey

Appendix B. The material presented in Appendix B, though incomplete, does indicate that some inland river terminals are experiencing landside access problems. Terminals on the nation's inland waterways and rivers are important to national and international commerce. Further study should provide more conclusive evidence about the extent and severity of their landside access problems.

OUTLINE OF REPORT

This report covers four broad subject areas that influence landside transportation access to ports: physical impediments, land use policies, regulatory constraints, and institutional issues. Chapter 2 provides background on the importance of ports to the U.S. economy and discussion on trade and transportation trends that affect the demands placed on U.S. ports.

Physical impediments are discussed in Chapter 3, and some possible solutions are offered. Land use issues are reviewed in Chapter 4, and suggestions are made to port officials on how to influence the local zoning and land use decisions that affect landside access to their ports. Chapter 5 contains a review of major existing and pending regulations affecting landside access; it offers some suggestions for facilitating transportation improvements within the guidelines of environmental protection; it also proposes some modifications to streamline the regulatory process. In Chapter 6 access issues that concern national defense and security are described. The institutional issues that arise when port officials attempt to address landside bottlenecks—by improving highway or railroad access—are reviewed in Chapter 7. Chapter 8 is an overview of the relationship of ports with the private users of their terminals and their labor unions in which suggestions are offered for improving internal operations in ways that might reduce the peak demands of port terminals on surface transportation systems. The AAPA survey questionnaire is provided in Appendix A, the description of selected results from the survey of inland river terminals is provided in Appendix B, and a glossary is provided in Appendix C.

lieved should be considered in the reauthorization of the pending federal surface transportation programs. The committee's report identifies a wide variety of options addressing port access that will be of use to ports, all levels of government, and private industry. In December 1991 the Congress passed and the President signed the Intermodal Surface Transportation Efficiency Act (ISTEA). Several of the options recommended in the committee's interim report were adopted. The ISTEA, which reauthorizes the federal surface transportation programs for 6 years, shifts federal transportation policies in many important ways, some of which can benefit ports with landside access problems. These new opportunities are identified throughout the report.

In February 1992 the committee completed the first phase of the present report, which focused on general cargo ports. Since that report was completed, the DOT study team has completed its visits to bulk and neo-bulk ports. The new material has been integrated into this report.

REFERENCE

Urban Harbors Institute. 1992. *Landside Access to Cargo Ports Roundtable Problem Definition and Possible Solutions.* U.S. Department o Transportation.

Background

Throughout the history of maritime transportation in
States, ports have tended to specialize in various kinc
partly because of the produce or demands of their h
and partly because of the natural attributes of their ha
several reasons, most general cargo terminals are public
although individual terminals may be operated by private s
companies. Many bulk commodity terminals are privately
operated. General cargo and bulk cargo facilities are tre
rately in the following two sections; many ports, however
minals for moving both types of cargo, which depend or
inland infrastructure.

GENERAL CARGO PORTS

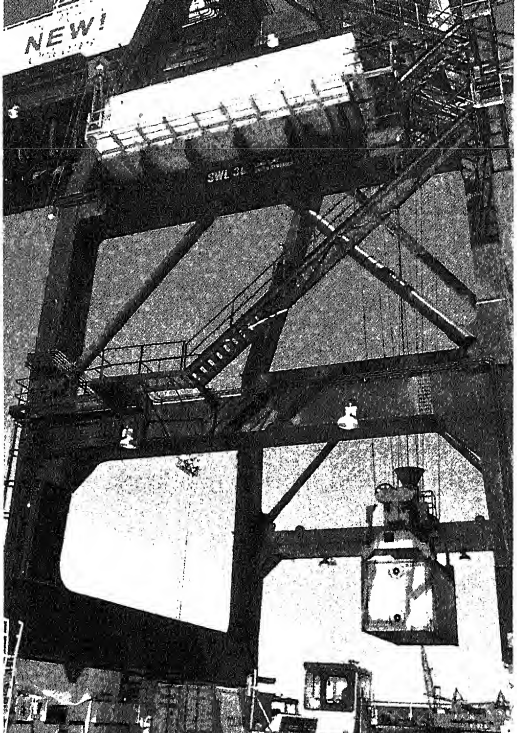
Before containerization, general cargo terminals operated
numbers of employees in a time-consuming, labor-intensi

another mode. This process is called a break-bulk operation. Bulk cargo, in contrast, was off-loaded by conveyor belt, pipeline, or crane, because it lent itself to economies of scale and automation more readily than general cargo.

Some terminals and ports continue to specialize in general cargo break-bulk operations, but the growth in containerization and intermodal transportation has substantially changed the design and operation of most general cargo terminals and ports. For example, instead of ships having cranes to move their own cargo, terminals that handle containers have massive cranes on the dock that move the containers from ship to shore; these cranes improve the productivity of the ship-terminal interface. They also reduce the number of piers at which containerized general cargo can be unloaded since fewer piers offer this expensive equipment. This concentration of cargo at specific terminals has direct implications on the amount of land needed and the landside routes that serve the terminals.

Container and Intermodal Revolution

During the past 30 years, innovations and cost reductions in the transportation of general cargo imports and exports have been little short of revolutionary. Most general cargo now moves from origin to destination in steel containers that reduce handling costs, pilferage, and damage in transit. Ships have grown enormously to gain greater economies of scale: the container ships of the 1960s could carry a few hundred containers; the largest vessels today can carry 4,500 twenty-foot equivalent units (TEUs). The cost reductions for general cargo have been so large that the biggest container ships have brought the cost per ton-mile of moving general cargo down to that of bulk cargo (Eyre 1989). (Not all container ships on order are so large, however, because some markets are more suited to ships in the 2,000- to 4,000-TEU range.) The gigantic cranes that move these containers from ship to shore (cranes that port operators, rather than ship owners, generally must invest in) have also



Major productivity gains in the movement of general cargo have possible by containerization and intermodal technologies (*photo tesy Joe Rodriguez, Port of New Orleans*).

to be 25 to 40 percent less than that of moving con flatcars, which is also roughly equivalent to the cost of m cargo over land (Talley 1988; Hayuth 1987). Continue terminal productivity are likely, but they will probably c information systems technology, design improvements, haps, improved labor-management relations rather than economies of scale provided by new cranes, ships, and (see Chapter 8).

Because the transportation system in the United States i tive, the cost savings of the intermodal revolution have b

on to shippers, producers, and consumers. Automobile manufacturers in the Midwest receive components partially assembled in Asia that arrive by container. American farmers can realize substantial cost savings when shipping produce such as cotton to the Far West, because even bulk cargoes have begun to move in containers. Consumers all over the country benefit from the lower cost of goods shipments. A consumer in Los Angeles can buy a pair of jeans shipped by container from Hong Kong for which the transportation cost is only 25 cents (Kagan 1990).

Containerization and Intermodalism

Maintaining and building on the efficiency of the intermodal system are important to the competitiveness of U.S. goods and to lower costs for consumers. In some segments of the freight transportation industry "intermodal" is defined as the transfer of containers from ship to rail. This study committee, however, sees the term in a larger context. Its definition includes transfers between all freight modes involved in general cargo transportation (ship, rail, and truck), taken as a system for moving freight from origin to destination by its most efficient means.

The most efficient form of freight transportation is one in which the goods move in an uninterrupted flow from shipper to receiver. In actual practice, however, most freight movements of farther than 700 to 1,000 mi require more than one mode. For maritime shipments—which must be transferred from land to water and water to land—intermodal transportation is inescapable. The landside movement for many overseas shipments may amount to no more than a short trip to and from the docks by truck (referred to as "drayage"), but that transfer between modes is expensive and time-consuming. When the origin and destination are well inland and most of the landside movement is by rail, it is still usually necessary to pick up and deliver by truck. Thus, two land modes may be used. Moving goods from rail to ship and ship to rail usually requires truck drayage, and therefore two more modal transfers.

relatively impregnable, offers protection from the elemen
the chances of damage, and almost eliminates the pilferag
to plague break-bulk operations. Moreover, refrigerated
containers have been developed to carry specialized car
attributes are important, but they are eclipsed by the adva
the container is unitized and, at least in international trade,
As such, the container lends itself to mechanized, even a
handling. It is this standardization and mechanization that
improved the efficiency with which ships, trains, and
loaded and unloaded and cargo is transferred across marin
from one mode to another.

Although intermodal transportation existed before co
tion, the quick and easy interchange of containers between
contributed directly to the steady growth in intermodal
recent years and has helped create a distinct industry for i
container transportation. Today's intermodalism has been
only by containers and container-handling technology, but
application of modern logistics concepts (with the help of c
to the business of moving freight. Manifestations of this a
include the widespread availability of single through (poin
rates and single bills of lading (considerably reducing pa
continually updated and readily accessible information ab
cation and status of shipments; the growth of volume a
contracts between shippers and carriers; the general adopt
riers of hub-and-spoke operations; the development of inla
and delivery networks with carefully coordinated schedule
trains, and trucks; and the corporate consolidations and m
have led to integrated intermodal transportation firms th
end-to-end control over international freight movements.
ganizational and institutional innovations were just as rev
as the technological innovations in equipment. The comb
containerization and intermodalism has been synergistic:
ization increased the practicality of intermodalism, and i
ism increased the efficiency of containerization.

ing the part of U.S. foreign trade that is waterborne (i.e., excluding all air shipments and overland trade with Canada and Mexico) and containerized. Recent estimates suggest that the value of containerized trade is approaching $200 billion a year (TRB 1992a).

Certainly any industry that handles nearly $200 billion in goods each year is a major factor in the American economy, and there is every reason to believe that this industry will keep growing, if not at quite the same high rate. Containerized cargoes might represent 85 to 90 percent of general cargo by the end of the century, and even the most conservative estimates suggest an annual compound growth rate of more than 2 percent a year (Chadwin et al. 1990). Estimates for the West Coast tend to be higher because of the burgeoning Pacific Rim trade; these estimates suggest annual growth rates of 5 percent (Sclar 1991; Wharton Econometric Forecasting Associates 1987).

BULK PORTS AND TERMINALS

In the highly competitive enterprise of bulk commodity shipping orts worldwide have been increasing the efficiency of their opera ions through capital investments that increase throughput and de crease labor costs (Branch 1986). Ports unable to offer efficien oading and unloading risk losing commerce to ports that offer these facilities. In the United States, many bulk handling terminals are privately owned and operated. The shipping lines, railroads, and companies that own these facilities have invested in increased auto mation to maximize the efficiency of ship or rail operations. Because most bulk commodities are of a relatively low value per ton, transpor tation makes up a larger share of the total cost than it does in contain erized cargo. This increases the emphasis on economies of scale Modern dry-bulk handling facilities are designed to minimize ship and rail car dwell time by speeding the loading and unloading pro cess. This is accomplished by large-scale technologies: massive cranes, continuous-feed conveyor belt systems, and high-volume gravity-fed loaders supported from stockpiles fed by long, highly efficient unit trains or low-cost, high-volume barges.

Bulk and neo-bulk commodities account for a major share of the value of U.S. exports and imports handled by U.S. ports. Census data

Capital investments in bulk-handling technologies have increased throughpu and reduced labor costs (*photograph courtesy Port of Tacoma*).

the study committee by the Maritime Administration) indicate tha the total value of all import and export freight was about $458 billio in 1990; noncontainerized goods, most of which were bulk and neo bulk, accounted for about $258 billion of these commodity moves.

Long-range forecasts of trade imply that the total tonnage of inter national cargo shipped to and from the United States could tripl between 1990 and 2020 (Wharton Econometric Forecasting Associ ates 1987). According to forecasts of total world rate provided to thi study by DRI/TBS World Sea Trade Service, the tonnage of tota international ocean trade could double between 1992 and 2020; thi same forecast shows the TEUs of containers tripling by 2010. Thes growth rates have important implications for seaports and indicat ever-growing demands on the landside transportation system tha serves them.

orting imports and exports. To the extent that export costs rise, American products can become less competitive abroad, which would weaken U.S. economic growth. To the extent that import costs ise, consumers pay higher prices for goods, resulting in an efficiency oss to the economy.

The issue of landside access to ports, although local in nature, has ational policy implications. The first, and most obvious, questions address the scope and severity of the problem: how severe and widespread is the problem today and how much will it increase in the future? The answers, however, are not so simple; they depend on a ariety of influences affecting international and domestic transportation and will vary from port to port depending on market demand and local circumstances.

The complexities in estimating the consequences for the nation of specific landside access problems is compounded by a lack of adequate data on freight flows. Without information on the volume of trade flowing through specific points, its origin and destination, the available capacity on alternative routes and modes, and the cost of using these alternatives, it is difficult to estimate the precise timing and location of landside bottlenecks. A Transportation Research Board report found that "the biggest gap in [the U.S. Department of Transportation's] multimodal data programs is in flow data" and identified this as a priority for the new Bureau of Transportation Statistics mandated by the 1991 Intermodal Surface Transportation Efficiency Act (TRB 1992b).

Given the complexities of the transportation demand and supply relationship and the lack of adequate detailed data, it is only possible to describe broad influences on supply and demand. On the demand side the issues affecting landside access appear to be

- Current and projected demand for imports and exports, and
- Growth potential of containerized cargo.

On the supply side the issues appear to be

- Adequacy of harbors, channels, and berths;

ports and exports; the effects on the transportation system are com plicated further because dimensions of supply and demand ar interrelated. For example, shipping lines estimate supply and deman for containerized cargoes and order ships on the basis of these projec tions. As ships grow larger or more efficient (or both), the cost o ocean transport falls, which increases the attraction of shipping by container—even for some commodities not considered general cargo In addition, the advent of intermodal transportation and container ization has caused the cost of moving cargo across the continen by rail ("land-bridging") to become competitive with the cost o moving it by sea through the Panama Canal. This has increase freight flows through ports for cross-continental shipments that for merly moved by sea. Most land-bridge traffic originates in Asia and i bound for the Midwest and East Coast of the United States. It i possible that increased manufacturing in Southeast Asia will produce sufficient volumes of cargo headed for the East Coast that it wil become economical to ship this cargo by way of the Suez Canal an across the Atlantic Ocean rather than across the Pacific Ocean an across the continent via land bridges. For East Coast–bound carg originating south of Hong Kong, the Suez Canal–Atlantic Ocea route is shorter than the Pacific Ocean–land bridge route. In the shor run the increased freight flows through ports used for land-bridgin may cause dislocations and increased congestion. Over the longe run, adjustments in the supply of transportation facilities ar possible.

Estimates on the supply side are also difficult to make because no all are driven by economics. Some ports will have trouble with neigh borhood groups or environmental issues and may be unable to ex pand to meet market demand, even though they have considerabl advantages over other ports in location or transport costs. (Political, social, and institutional constraints on port capacity are discussed in greater detail in subsequent chapters of the report.) Although the capacity of some ports is limited by such constraints, some commu ities have made new capacity-enhancing investments, some of which may prove to be in excess of demand. Given the complexity of upply-and-demand relationships and the lack of adequate freight flow data, this study can address their national consequences only in a qualitative manner, with the assumption that it is possible to draw reasonable inferences from such an approach.

Demand for Imports and Exports

Exports have been a growing share of the gross national product (GNP), reflecting the growing globalization of the U.S. economy. In 1970 exports accounted for about 5 percent of GNP; by 1990 this share had more than doubled. Imports have grown even faster, resulting in a balance-of-trade deficit in recent years. Most forecasts show continued growth in both exports and imports. As international trade grows, the potential increases for congestion on the rail lines and highways serving the ports.

Growth Potential of Containerized Cargoes

Some general cargo ports continue to specialize in specific, noncontainerized cargo such as some food and forest products and automobiles. Containerization, however, has made substantial inroads into cargo not formerly considered suitable. Foodstuffs, bulk cargo such as logs and cotton, and even commodities such as fresh flowers can take advantage of low rates and are increasingly containerized (Chadwin et al. 1990, 113). Innovations have even included the development of stacking systems that allow automobiles to be containerized; commercial applications of this new technology began in 1992 (*American Shipper* 1992, 59). As indicated earlier, most general cargo is likely to be containerized in the future, and much bulk cargo may be as well. Shippers of bulk cargo can take advantage of low transportation rates for containers that would otherwise be moved empty in backhauls. Developing countries that are important trading partners are investing in container ports to export their goods.

Adequacy of Harbors, Channels, and Berths

By most estimates the nation has ample waterside capacity of natural harbors, channels, and berths for shipping (although dredging to

ships. The newest container ships have been designed so that they can carry more boxes than previous designs without requiring deeper drafts. Because of shifting traffic patterns caused by land-bridging, a significant amount of general cargo now moves across the country by rail instead of through the Panama Canal, and container ship dimensions are no longer constrained by the width of the canal. Hence, the newest container vessel designs carry more cargo because the width rather than the draft of the ship is increased (Clayton 1989, 24). The largest bulk commodity ships are constrained by the canal and take an all-water route around South America.

Relatively few U.S. harbors have channel depths adequate for the largest, most efficient vessels that are designed to carry bulk commodities when fully loaded. The largest vessels achieve economies of scale that are important to commodities of high density and relatively low cost per ton. Although many U.S. ports have channel depths of 40 ft or more, for the contiguous 48 states, most of the deepest-draft vessel calls are made at the San Pedro Bay ports (Los Angeles and Long Beach), the Port Authority of New York and New Jersey, Baltimore, the Delaware River ports, and the ports in Hampton Roads (Marine Board 1985, Appendix G). The deepest-draft vessels can call at other ports with less channel depth, but to do so they must be loaded at less than capacity ("light loaded") and, in some cases, they are constrained to moving at high tide. Channels can be deepened at ports other than those with naturally deep harbors, but cost and environmental concerns make such proposals expensive, controversial, and time-consuming.[2]

Bulk commodities do not have to move by the deepest-draft vessels. Indeed, much of the nation's bulk imports and exports move via the Gulf Coast, where the vast majority of calls are made in ships that require no more than 40 ft of draft (Marine Board 1985). Drafts of bulk vessels on the Great Lakes are usually less than 30 ft. The economics of shipping a bulk commodity depend on many dimensions; for the Gulf Coast, the enormous volume of bulk commodities that move up and down the Mississippi River and the existence of many petroleum refineries make it economical to move commodities

coast (the Louisiana Offshore Oil Port). Petroleum is offloaded at this terminal and then shipped inland via pipeline.

The need for deeper-draft harbors does not apply to the inland waterways. Channel depths are typically 9 ft or less, which makes movement by barge the most cost-effective approach. Because terminals to serve these barges are not constrained by the need for harbors, there are many possible locations for bulk terminals.

Size and Characteristics of Shipping Fleets

By most estimates there is sufficient, if not too much, capacity in the liner trade. Besides the two largest U.S. flag carriers that offer intermodal service—Sea-Land and American President Lines—more than 30 ship operators provide regularly scheduled service between the United States and Far East and between the United States and Europe (TRB 1992b).

As container traffic grew, major shipping lines invested in ever-larger ships to gain greater economies of scale. Ships capable of carrying 2,500 to 4,500 TEUs are already calling at West Coast ports, and capacities greater than 5,000 TEUs are possible. Even so, there appears to be a market for smaller container vessels moving more specialized cargoes (Chadwin et al. 1990; Chilcote 1988). In addition, some major lines are ordering vessels of 2,000 to 4,000 TEUs (instead of those with the largest capacities) in order to provide their customers with smaller faster ships that provide more frequent service.

Seagoing vessels that move noncontainerized commodities are getting larger to achieve greater economies of scale. Vessels carrying automobiles have added decks and length. Those moving bulk liquids or grains have increased width and length in order to carry more cargo. Whereas the newest vessels are getting larger, most vessels designed for bulk commodities have design drafts of 45 ft or less. These vessels, however, are used in intercoastal trade or on shorter sea routes. Most long-distance moves are made in the largest vessels (Marine Board 1985, 29). As in the liner trade, there is excess capacity in the supply of bulk and neo-bulk ships.

Port Physical and Throughput Capacity

The high capital cost of modern seagoing vessels makes their dwel

and shipping lines are calling at fewer ports. In the intermodal trade, the ports that carriers select for calls are often referred to as "load center" ports. They are increasingly used as transfer points for cargo moving inland to destinations formerly served by other ports that previously received shipping line service. Although the trend toward load centering is often overstated—some ports that are no longer served by one shipping line may still be served by other shipping lines—the shift toward containerization and greater economies of scale in ship and terminal operations has tended to result in the concentration of cargo at fewer terminals. Concentrating cargo at some ports has also increased the demands on the landside transportation system of these ports. Many major load center ports are located in harbors that are also well suited to serving bulk commodities. The terminals that serve the bulk commodities are, in turn, served by the same rail lines and highways that are in greater demand to move containers.

The increased congestion at these ports, however, can be relieved over the long run by spreading the demand to currently underused facilities. As even the load center ports reach a certain level of saturation over the next 20 to 30 years, other lesser-used ports, such as San Diego, may emerge as important parts of the national intermodal system. Some of these ports may be served by the same shipping lines that currently transfer most of their cargo at their load centers. Others may be served by smaller, more specialized ships. It is not possible to be precise about whether or when currently underused ports will become economically attractive to shipping lines, but when examining problems of demand at ports that are used heavily now, it is important to keep in mind the potential relief these ports might offer.

At present, relatively few terminals can handle large container ships in the turnaround time required by shipping lines, and few ports have the other elements that are attractive for load centering: a large nearby market for containers, good highway access to serve regional markets, and double-stack rail service to the Midwest or opposite coast. Even so, many ports with several of these features are not yet load centers, and it is possible that over the next two decades most existing coastal ports will serve as a load center for some shipping line.

The status and attendant economic benefits of becoming a load

center port are considerable, and port communities have spent millions of dollars to attain that status (Chilcote 1988). As a result, competition among ports in the United States has become intense. A major difficulty for ports trying to improve their competitive standing is that the determinations are made by a relatively small number of major shipping lines. Some ports have gained new service at the expense of others (Chilcote 1988). Other major container ports have managed to hold on to a constant volume of trade. Gulf Coast ports have been disadvantaged by land-bridging serving their interior markets from ports on the East and West Coasts, although some, such as Houston, are building a growing container trade. Ports on the Great Lakes have been disadvantaged by land-bridging as well, partly because ships wider than the Panama Canal are also unable to negotiate the St. Lawrence Seaway.

Chadwin et al. (1990) speculate that the 1990s will see a major shakeout of ports throughout the industrialized West. Some failing ports, they suggest, will withdraw from the competition, especially those in urban areas that are coming under the increasing pressure of gentrification and environmental restrictions. For the longer term the fate of small and medium-sized general cargo ports is important. Although they move only a small share of international commerce now, they are important assets for the future.

The physical assets of ports are important to their throughput capacity, but throughput is also affected by many operational considerations. Labor-management relations, local work rules, cooperation (or the lack of it) among users of port terminals, terminal physical and operational design, and loading schedules of shipping lines all directly affect terminal throughput and the peak capacity demands placed on landside access routes. Hence, throughput capacity is a variable that cannot be estimated with any precision without conducting detailed engineering and economic studies of an individual port. Each individual port or port terminal can exercise a different set of options to help reduce peak demand on the landside system. Some ports can afford to open gates during the evening, some can begin to rely more heavily on rail as double-stack access is improved, and

each individual port has a different ability (or faces a different set of constraints) in responding to increased demand. Port terminal operations and how they affect access routes are discussed in Chapter 8.

Availability and Throughput of Rail Lines

The improved efficiency of rail shipments, particularly double-stack unit trains for moving containerized cargo, has radically changed the economics of shipping. No more than a decade ago, shipping lines in the Pacific sent cargoes to the East Coast by way of the Panama Canal, but now much cross-continental service with double-stack trains is quicker and cheaper. Ports served by rail lines with bridge and tunnel clearances adequate for double stacks have a considerable advantage over ports that have been unable to establish double-stack service. Because railroads move most of the containers destined more than 500 mi from the ports, Chilcote (1988) argues that the quality of rail service will increasingly dominate the choice of load center ports. Railroads, like shipping lines, have made major investments in double-stack trains, and they also emphasize the importance of terminal efficiency to reduce the waiting period while trains are loaded.

Adequacy of Road Access

All ports desire the efficient movement of freight from the ship, across the marine terminal, and onto a rail line or highway. The productivity benefits gained from container vessels, more highly automated marine terminals, double-stack trains, highly efficient unit-trains, and bulk-handling technologies are diminished if severe bottlenecks on the land side impede the efficient flow of traffic beyond the port. Although many containers off-loaded at a port may be headed for the local market (requiring drayage to nearby warehouses or ultimate destination points), many shippers also use trucks to serve inland markets within 300 to 500 mi of the port of entry. Many bulk cargoes are also destined for a local market. Tanker trucks are often the

Aside from the adequacy of the physical infrastructure, many other issues affect landside access. Logistics decisions made by shipping lines and railroads determine whether ports will receive double-stack service. Land use regulation helps determine land cost and availability to the port and influences the surrounding land uses and their effects on traffic congestion. Regulations defining eligibility for federal and state highway funds, wetlands preservation, air quality, and hazardous materials transportation affect the ability of ports to improve their productivity. The ability of ports to influence many of these issues is reduced in some respects by the ports' institutional status. These problems, and opportunities for reducing them, are addressed in the subsequent chapters.

NOTES

1. "Unitized" refers to the aggregation of cargo into a uniform unit, and "modular" refers to different units that are exact multiples and precisely substitutable, for example, a 40-ft container substituting for two 20-ft containers (VanDenBurg 1969, 23; Muller 1989, 119).
2. The need for and controversy surrounding dredging are treated thoroughly in a 1985 Marine Board report, *Dredging Coastal Ports: An Assessment of the Issues*, available from the National Academy Press, Washington, D.C.

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3

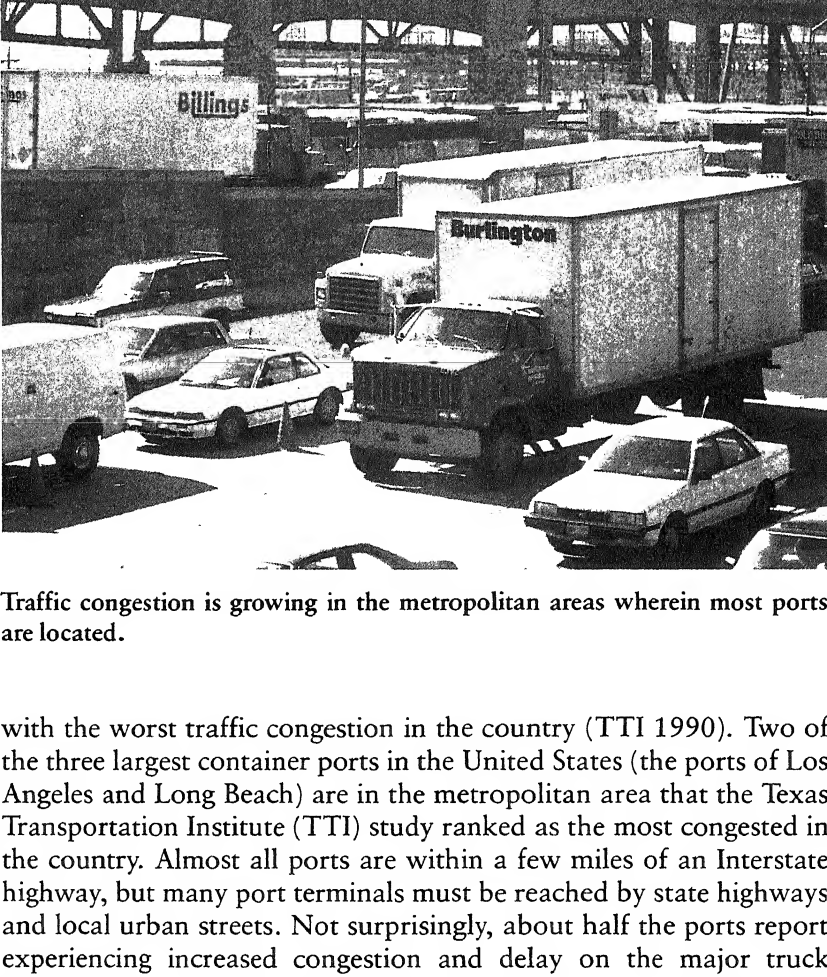
Physical Access

Infrastructure constraints to port landside access are characterized by deficient bridges, freeway access ramps, railway grade crossings, and railway tunnels and underpasses, as well as congested or inadequate roadways serving marine terminals. These constraints are not systemwide, but site-specific. They either impede the flow of traffic at a certain point, such as a rail-highway grade crossing, or hamper or prevent the use of equipment that was developed after the facility was built, such as double-stack trains. Thus, the impediments increase the time and cost of moving goods beyond the docks of port terminals.

IMPEDIMENTS

Roadway Access

Congestion



Traffic congestion is growing in the metropolitan areas wherein most ports are located.

with the worst traffic congestion in the country (TTI 1990). Two of the three largest container ports in the United States (the ports of Los Angeles and Long Beach) are in the metropolitan area that the Texas Transportation Institute (TTI) study ranked as the most congested in the country. Almost all ports are within a few miles of an Interstate highway, but many port terminals must be reached by state highways and local urban streets. Not surprisingly, about half the ports report experiencing increased congestion and delay on the major truck routes that serve their marine terminals (Table 3-1). This problem is more pronounced for container ports: 64 percent of container ports report that the major roads serving them are usually or always heavily used by passenger traffic—and suffer the resulting congestion and

TABLE 3-1 Infrastructure Impediments Identified in AAPA Survey

Impediment	All Ports ($n = 54$)		Container Ports ($n = 25$)		All Other ($n = 29$)	
	No.	Percent	No.	Percent	No.	Percent
Truck routes congested						
Usually or always	27	50	16	64	11	38
Sometimes	22	24	6	24	6	21
Additional rights-of-way for new routes available	12	41	9	36	13	45
Drawbridges contribute to congestion						
Usually or always	7	13	5	20	2	7
Sometimes	11	20	7	28	4	14
oadway turning radii adequate						
Usually or always	43	80	19	76	24	83
Sometimes	8	15	4	16	4	14
Port terminal served by weight-restricted bridges	7	13	4	16	3	10
Truck routes clearly marked						
Usually or always	34	63	19	76	15	52
Sometimes	11	20	3	12	8	26
Rarely or never	7	13	3	12	4	14
Rail tracks in highway rights-of-way	34	63	18	72	16	52
Numerous at-grade rail-highway crossings	25	46	14	56	11	38
Inadequate clearances for high-cube double stacks	12	22	9	36	3	10

NOTE: The questionnaire from which these results were obtained is given in Appendix A.

Examples from the U.S. Department of Transportation (DOT) site visits help illustrate some of the problems. In the Pacific Northwest both the Seattle and Tacoma ports have good road access, but Seattle's port is surrounded by a densely developed urban environment

and tourist traffic. Users of the port have expressed concer
city has put greater emphasis on developing tourism than o
ing the needs of the freight transportation. Once past cong
streets, however, access to Interstate 5 is good.

Tacoma's main landside access route to I-5, though co
times, is also good, according to the DOT study team.
access to the Interstate system will be further improv
planned removal of the Blair Waterway Bridge and by an in
extension from I-705 into the harbor area. In 1985 peak-
gestion was not perceived as a serious impediment to comm
congestion was expected to be eased by the completion of
705 and 5 in the early 1990s (TAMS 1985). Now the
highways that serve these ports are congested during peak h

The ports of San Francisco Bay (including Sacramento)
connections to Interstate highways; however, the main acc
serving the ports of Oakland and San Francisco were seve
aged during the 1989 Loma Prieta earthquake. Although p
well under way, it will be some time before these routes are
Even before the loss of a key connection to the Interstate, c
on I-80 slowed truck movements to and from Oakland ar
tion in San Francisco delayed traffic destined for the city's p
other parts of the country, the access problem is not just th
of the roads serving port terminals but also the levels of con
the major primary highways connecting ports with the ma
serve.

The ports of Los Angeles and Long Beach are only 1 to
I-710 and I-110, but they depend on local streets for acce
Interstates, and the three rail lines serving the ports cross n
streets at grade, often delaying traffic (rail access issues are
in the next subsection)—and, as mentioned, the major hi
the Los Angeles area are rated the most congested in th
Some access problems have been eased by the developm
Intermodal Container Transfer Facility operated by Southe
Railroad, which is a joint project of the two ports. Road
drayage to this facility, by way of the Terminal Island F
good. But projected growth in cargo movements through
implies increased congestion on all landside access routes s
ports. The two ports and their area governments have an
program (the Alameda Corridor) to improve local access

but its success will depend on whether the neighborhood approves the upgrade of one roadway into a major freight corridor and whether the railroad that controls the most direct line to the ports will agree to sell (neighborhood issues are discussed in the next chapter).

Some road access problems for Gulf Coast ports that were visited by the DOT study team are being addressed. The Port of New Orleans will benefit from the Tchoupitoulas Corridor, a recently funded project that will improve truck access to the port. The ports on Galveston Bay generally have good road access, and the Texas Department of Transportation is actively working with the ports to resolve those problems that do exist. For example, the state initiated a study of inadequate access from the causeway serving Galveston Island and the port's container terminal. A major project has been planned to bypass a city street serving the terminal by providing a direct ramp to the terminal. This project would also eliminate problems with at-grade rail crossings.

The DOT study team also visited major Mississippi River ports. Although St. Louis has some problems with aged bridges, most of its barge terminals have few problems with road access. The terminals are spread over many miles of riverfront, which results in less concentration of traffic at any one point. Because there are many possible locations for terminals, they can locate wherever they will have good access. At Memphis, however, the terminals are on an island next to the city. The port director expressed concerns about the poor design of the single, winding access route serving the marine terminals. He was concerned about both inefficient traffic movements and the safety hazard.

Two major bridges serving the Port of Charleston are old and deficient and thereby contribute to congestion on the routes serving the ports. Upgrading them, however, could cost $435 million, which is far more than the total federal-aid bridge replacement program for the entire state (this program totaled $15 million in FY 1990). Bridges of this size can be financed through a special discretionary federal fund for high-cost bridge replacement, but many bridges around the country compete for these limited funds. (The role of the

on these bridges. Nevertheless, opening I-526 might create
tlenecks on local streets, and port officials say that cor
these may be ineligible for federal and state aid. Trucks
North Charleston and Columbus Street terminals must t
streets with heavy traffic.

Road access to the Virginia ports in Hampton Roads is
good; the main problem is that highways are congested d
periods. Growth in the Tidewater area—at the port and
rounding region—is overtaxing the transportation system.
ple, many of the routes serving the southern terminals a
Roads traverse Suffolk, where traffic on the main down
has doubled during the past 15 years. Trucks constitute 6(
that traffic.

The Delaware River ports, which include Philadelphia
New Jersey; and Wilmington, Delaware, are all close t
highways. Except for Wilmington, they have good acces
narrow roads serving the Port of Wilmington create
tlenecks. They are also intersected by at-grade rail cro
block road traffic when in use.

Road access to the ports of New York and New Jer
Boston is generally not as good as it is elsewhere. Like mo
the East Coast, freight movements for these ports de
heavily on trucks than on rail. Most incoming containe
80 percent—are destined for the local market. Similarly,
commodities handled by the Port Authority of New Yor
Jersey originate from or are destined to the greater New
area. In Boston, the loss of three major transmission pipel
had to be closed because of their age and could not
because of their cost and proximity to population, has r
much larger share of total fuel oils handled by the por
move by tanker truck. The area's aged infrastructure, con
heavy traffic volumes, cannot convey this freight without
age costs and considerable delay. The major interstate ro
the Port of New York and New Jersey's facilities in Brook
Greenville area of Jersey City, for example, typically incor
standard design features: most were built before the Int
gram began, and they have narrow lanes and poor geome
In addition, traffic volumes are heavy. New York's Red H
nal, in Brooklyn, may be seriously affected by the planned

between the port and the rail terminals in New Jersey. During the 8-year rehabilitation program, the already-congested facility must operate well below its capacity, and more congestion will increase drayage costs between Red Hook and its rail service. (The recent institution of a barge service from the Red Hook Marine Terminal to Port Newark, N.J., offers a valuable alternative for freight movements to and from Red Hook.)

As roadway capacities are reached, ports can encourage the development of additional highway capacity, but in places such as New York and Boston such options are severely limited. Ports throughout the country are constrained by neighborhood opposition (discussed in Chapter 4) and by the lack of available rights-of-way. Only 40 percent of ports indicate the existence of undeveloped rights-of-way for new access routes (Table 3-1).

Drawbridges also contribute to congestion at some ports. About 10 percent of ports report that drawbridges in the area usually or always contribute to congestion, and 20 percent of the ports indicate that they sometimes contribute to congestion (Table 3-1). The problem appears to be more prevalent at container ports (Table 3-1).

Problems with weight-restricted bridges are cited at only 13 percent of ports (Table 3-1). As discussed, however, bridge replacement or rehabilitation is expensive and funding difficult to obtain. In addition, if a bridge is more than 50 years old, it must be evaluated for preservation under federal historic preservation guidelines. This process can be time-consuming and expensive.

Design

In the opinion of 87 percent of the respondents to the AAPA survey the access roads are usually or always adequately designed to handle legal truck weights at most ports. Most of the respondents (80 percent) indicate that roadway intersection design to accommodate truck turning radii is usually or always adequate, but 15 percent report that turning radii are only sometimes adequate, and two respondents indicate that turning radii for routes serving their port terminals are rarely or never adequate (Table 3-1).

Adverse consequences of obsolete design standards are noted by New York port officials with respect to turning radii, both for New

docks. The access ramps were designed for 53-ft trailers)
now the norm for seagoing containers. The railcars that carry them are long enough for two 40- or 48-ft containers set end to end.

The adequacy of the current geometric design for marine containers is a complex issue. A recent report examines various design features and how they affect and are affected by trailers and containers of widths and lengths that are allowed by federal legislation but that exceed the values assumed in the design of roadways built in the past (TRB 1989). As noted in the report, the Surface Transportation Assistance Act of 1982 required all states to permit trailer lengths of 48 ft, but many roadway features were built according to designs based on 40-ft semitrailers (TRB 1989, 128). Even the 1984 American Association of State Highway and Transportation Officials (AASHTO) design guide was essentially completed before the 1982 legislation was enacted, and it continued to rely on design vehicles smaller than those permitted in the legislation. AASHTO's revised design guide adds several design vehicles, including tractor-semitrailers with 48- and 53-ft trailers (AASHTO 1990).

Longer trailers and containers pose a specific problem for turning radii. At an intersection designed for 40-ft trailers, a driver in a cab pulling a 48-ft trailer must compensate for the offtracking of the rear wheels. For the truck to clear the intersection without the rear wheels hitting the curb, the cab must swing wider than the track of the rear wheels, and this causes the cab to encroach on the adjacent lane.

In evaluating the adequacy of current designs to handle longer vehicles such as 48- and 53-ft trailers, it should be kept in mind that few public highways are designed to fully accommodate the largest vehicles that will use them. For reasons of cost-effectiveness, AASHTO gears its design policies to the vehicles that commonly use the roads and tolerates some vehicle movements that exceed design values (TRB 1989, 131). Hence, whether design that is insufficient for some uses should be rectified depends on the tolerances assumed in the design, the extent of deviation from the design, and the cost-effectiveness of and available funds for correcting it. Although it is important that the designs of public infrastructure keep pace with the dimensions used for containers in international shipping, the costs of improving a facility—which are typically substantial—must bear some relationship to the benefits of the improvements.

older, built-up cities. Various bridge problems on truck routes were noted in the site visit reports for Charleston, New York and New Jersey, Philadelphia, St. Louis, Tacoma, and Toledo. Two bridges on a key route in Charleston are weight-restricted for trucks, one to 70,000 lb and the other to only 20,000 lb. These limits prevent use by a great many trucks that are otherwise well within legal weight restrictions.

In cases in which the existing design standards appear unsuited to a specific need, the granting of exceptions to design standards during new construction or major rebuilding is fairly common. For example, state highway departments frequently request and receive modifications to design standards (including bridge width) from the Federal Highway Administration (FHWA) when they encounter problems (TRB 1987). Bridges built to modern standards (HS-20 and HS-15 design vehicles) can handle properly loaded marine containers without overstressing the bridge members (TRB 1990, 95–97). But the federal bridge formula may restrict heavy cargo loads of containers hauled on short wheelbases. In some cases reducing the kingpin settings allows longer containers to be hauled without causing excessive offtracking, but the bridge formula imposes a penalty on the maximum weight the container can hold when the distance between axle groups is reduced. Highway design engineers consider such factors as trailer length and gross vehicle weight when they design ramps and bridges, but the design would be altered only if there were sufficient volumes of heavy or oversized vehicles to impede traffic flow, create safety problems, or cause a facility to deteriorate prematurely.

The difficulty highway engineers face in adjusting designs to the increased dimensions for trucks has its analogue on the water side. Increased ship width and height also imply changes in bridge design. However, the need for greater vertical clearance over water, rail lines or other highways, or for more horizontal distance between bridge piers, will raise significant investment issues but not significant design issues. For example, officials at the Port of Houston noted that the standard bridge height for a new bridge would cause problems for the many oversized loads moved to the port by truck. Increasing the vertical distance from 16.5 to 30 ft, as requested by the port, however, would have added $7 million to $8 million to the total cost. (In this case the Texas Department of Transportation agreed to raise the

Highway and bridge design standards have lagged behind the dimensions of large trucks, but the standards in the revised design guide of AASHTO and the exceptions to design permitted by FHWA appear adequate for designing physical facilities for vehicles transporting marine containers. For roadway and bridge design to handle truck movements of containers, the issue appears to be one of funding and priority to replace outdated facilities, not one of inadequate design standards.

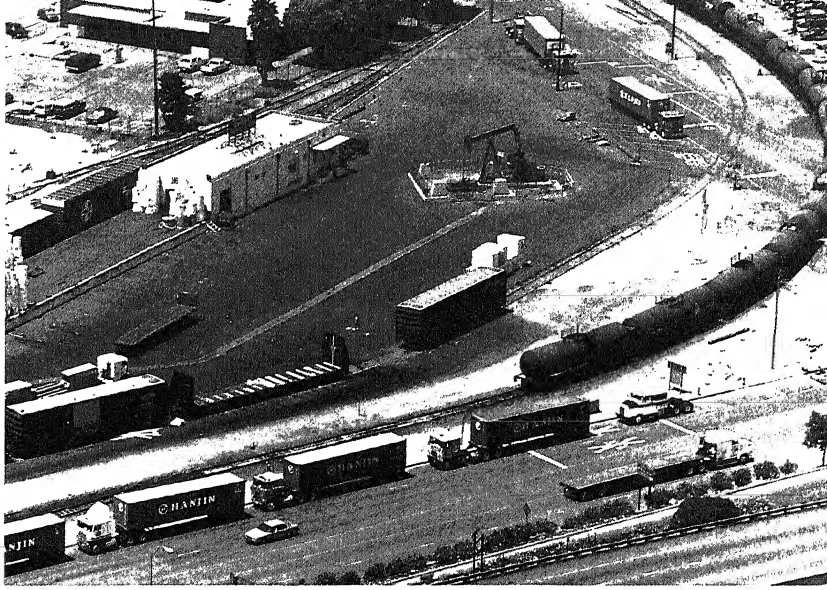
Signing and Marking

At most ports (63 percent), the truck routes serving the port terminals are believed to be usually or always clearly marked, but at 20 percent of the ports, the truck routes are only sometimes well marked and at 13 percent they are rarely or never well marked (Table 3-1). The Delaware Valley Regional Planning Commission has recommended substantial improvements in the directional signage for the many terminals in the Delaware River ports complex. Improved signage and detailed maps for truckers would reduce missed destinations and backtracking and would help keep trucks on designated truck routes as opposed to local and residential streets.

Railway Access

At-Grade Crossings

Ports can try to reduce truck congestion on the highways that serve them by facilitating rail access, but often the problems with congestion are accentuated by rail lines that intersect local streets with at-grade crossings. Two-thirds of the ports indicate that rail lines that serve the port must share at least some of their rights-of-way with a public street. Almost half of the ports (46 percent) report that they are served by rail lines with many local at-grade crossings (Table 3-1). This problem appears more prevalent at container ports than at other ports, perhaps because there is a higher proportion of container ports



At-grade crossing of a rail line with a port access route delays truck traffic serving the port.

grade. Trains occasionally tie up traffic, but the tie-ups have not caused undue concern. Similar problems occur in Oakland, Richmond (California), Memphis, Chicago, Toledo, and Wilmington (Delaware). Longer trains and greater throughput in the future, however, could increase traffic conflicts. Rail-highway grade crossing problems were cited in New Orleans and Los Angeles, but these cases appear to be due to relations between the ports and neighborhoods. In New Orleans, for example, there are a number of grade crossings on a Norfolk Southern line through a residential area. These grade crossings are said to be a factor in the neighborhood's resistance to the double-tracking of the line. The neighborhood, however, also opposes the construction of grade separation facilities. Similarly, the Port of Boston has deferred improving a spur rail line because of neighborhood opposition.

Double-Stack Access

It has become increasingly important for container ports to have

"high-cube" containers; they are becoming perceived as the industry standard. Almost half of the container ports (48 percent) have bridge or tunnel clearances adequate for them to be served by high-cube double-stack trains, but 36 percent report that they do not (Table 3-1).

Some ports may not receive double-stack service for economic as well as physical reasons. Although double-stack service is available within 20 to 30 mi of downtown Boston, the rail lines serving Boston's port have been reluctant to commit to double-stack service to the port's terminals because of the high cost of obtaining adequate clearances under highway bridges, the need to reconstruct railroad bridges to carry the heavier double stacks, and the relatively small volume of container shipments into and out of Boston. At other ports, however, double-stack service is in the offing. For service to Hampton Roads, for example, the Norfolk Southern Railroad is spending $4.6 million to improve tunnel clearances in West Virginia so that it can provide high-cube double-stack service to and from the Midwest. At the Port Authority of New York and New Jersey, Consolidated Rail Corporation (Conrail) announced in May 1991 that it would begin providing double-stack service from its railyard in Portside, New Jersey, to Chicago. Subsequently, in August 1991 that service was shifted to the Expressrail terminal, which is an on-dock facility. Double-stack service from the New York area to Philadelphia and from Philadelphia southward is not available. The cost of providing double-stack access into Philadelphia has been estimated to exceed $40 million. Conrail, one of the major railroads serving the Philadelphia area, has focused its investments on New York and New Jersey. Canadian Pacific, however, is promoting double-stack access, and a major study is under way of the economic viability of double-stack service. The state has conditionally committed $40 million to improving the rail system through Pennsylvania and the Philadelphia terminals to accommodate double-stack trains and is prepared to invest these funds if the ongoing study concludes that they are warranted. Although most of the issues of double-stack access occur on the East Coast, constraints on double-stack service to eastern ports is also a problem for the West Coast ports that serve East Coast markets and for land-bridge freight movements

OPPORTUNITIES

The DOT site visit reports and the AAPA survey indicate a host of potential access problems. Road access to many ports is good or adequate, but congestion is a growing problem. Will these already-congested routes be able to handle the increased cargo projected for the next three decades? Shifting more traffic onto the railroads may ease some problems, but many ports are served by rail lines that intersect many local streets at grade, which also results in congestion for motorists. In addition, because much of the international cargo entering the seaports is headed for the local area, particularly at East Coast ports, a substantial amount of truck traffic over local roads will always be necessary. Increased rail service, however, does appear to offer promise for the long run in reducing demands placed on the highway system. Many ports appear to have resolved their access problems to allow service by double-stack trains, but problems still exist at some East Coast ports and the resolution of at-grade rail highway crossings at many ports is required.

Ports have identified a variety of strategies for solving their land side access problems; they include developing dedicated freight corridors from the port terminals to major highways and railheads, relying more heavily on rail service on or near terminals to reduce the need for drayage, developing inland ports, and relying more on barge movements for shipping containers to other coastal cities or terminals.

Dedicated Freight Corridors

Of the 54 respondents to the AAPA survey, about one-fourth believed that practicable options exist for rail-truck corridors (Table 3-2). Among the dedicated freight corridors under consideration, the corridor being planned for the ports of Los Angeles and Long Beach is the most ambitious (Hicks 1991). The San Pedro Bay ports are served by three railroads, each of which has many at-grade roadway crossings. The corridor would consolidate the rail service onto one line that would connect the ports to the major railheads serving the Los Angeles area. In addition, road access from the ports to major highways requires using facilities of inadequate design. Therefore, the proposed

TABLE 3-2 Infrastructure Opportunities Identified in AAPA Survey

	All Ports ($n = 54$)		Container Ports ($n = 25$)		All Other ($n = 29$)	
Opportunity	No.	Percent	No.	Percent	No.	Percent
Viable options for consolidated rail-truck corridors	13	24	6	24	7	24
Viable inland ports	18	34	11	44	7	24
Feasibility of increased barge use as solution to landside congestion	13	24	6	24	7	24
Possibility of more efficient off-dock intermodal facilities than on-dock						
Yes	12	22	6	24	6	21
No	20	37	10	40	10	34

upgraded into a truck route. The 34 at-grade crossings would be separated or closed, and some segments of the corridor might be placed in trenches to reduce noise. At the time of this writing, the total cost is estimated at $1.6 billion to $2.2 billion. The ports of New York and New Jersey, New Orleans, and Boston also plan to upgrade truck routes or develop consolidated corridors.

The corridor concept has much appeal. The traffic congestion caused by trucks and passenger vehicles sharing the same routes and intersections could be greatly reduced by building facilities (both highway and rail) dedicated to freight movements. The reduced congestion would also cut down the excess vehicular emissions that result from stop-and-go traffic.

Corridors are expensive, however, as witnessed by the growing price tag of the Alameda Corridor in Los Angeles, whose initial $500

commensurate with the cost are all major issues. (Funding issues are discussed more in Chapter 7.)

On- and Near-Terminal Rail Access

The typical marine terminal has a rail line next to or within a mile of it. Recently there has been increased interest in having rail lines come nearer to—even into—the marine terminals to reduce the amount of drayage of containers between the ship and the rail cars. In concept on- or near-terminal rail service can have different configurations. The rail lines can come onto the dock and thereby permit containers to be moved directly from ship to rail via gantry cranes (this design is not used in the United States). Or, the rail lines can be adjacent to container storage areas, which, in turn, are immediately adjacent to the cranes used to unload the ships (this is the approach used in the United States).

With on- or near-terminal rail service, handling costs are reduced compared with having marine and rail terminals separated by several miles: drayage is greatly reduced and additional processing through gates is eliminated. These advantages are partly offset by other costs most notably, from the port's perspective, the amount of land that is consumed (Ashar 1990). (Issues regarding land use are addressed in Chapter 4.) Additional costs for the railroads include the cost of separating domestic from international containers and the increased switching complexity caused in double-stack operations (Smith 1989).

Of the respondents to the AAPA survey, about 37 percent appear to believe that on-terminal rail service would expedite cargo flows more than the typical off-terminal facilities (Table 3-2). Although the net benefit of facilities on or near the terminal depends on the circumstances of individual ports, when the economics are favorable, on- or near-terminal rail reduces demand on highways and thereby promises to reduce roadway congestion and air pollution.

Inland Terminals

Another way to improve port access would be to shift the bulk of

modal terminal at the port. About half of the container port respondents in the AAPA survey believe that inland terminals would work (Table 3-2). Many container ports now have either on- or near-terminal rail facilities that allow containerized cargo to be moved off the container ship and onto a rail car with a minimum of drayage. Trains comprising these rail cars could take the containers to a separate inland rail terminal, perhaps many miles inland, at which the containers would be sorted for local, regional, and national markets. These facilities would require an initial inland movement by rail, but transfers to trucks would still be required to transport containers destined for local or regional delivery because of the dispersed locations of the firms receiving or generating them. If such inland terminals were located away from urban streets and highways, however, their truck traffic would contribute less to urban congestion and air pollution.

These inland facilities would also help reduce the trucking of domestic containers destined for the periphery of a metropolitan area. Domestic containers move from inland in the United States to the railheads at or near port terminals, often at low rates to avoid empty backhauls. Once at the terminal, these containers are sorted for local markets and then trucked back through the city to their ultimate destination. Although an inland terminal would increase the amount of handling, as congestion continues to grow in and around major urban centers, the benefits of reduced drayage through these congested areas could offset this cost in some markets.

The inland terminal developed by the ports of Virginia and Norfolk Southern Railroad at Front Royal, Virginia (about 175 mi inland from Hampton Roads), though developed to compete with ports to the north, illustrates the concept. Double-stack service moves the containers directly to and from the Hampton Roads area to an inland terminal at which they are staged for movement to and from the Midwest. The Front Royal Terminal is still nascent, but it offers a useful test case for the inland terminal concept. If it works, it may offer a partial solution to access and congestion problems

terminals may depend in part on the ability to reduce at-grade onflicts.

Barge and Intercoastal Shipment of Containers

Yet another concept worthy of consideration is greater reliance on barge shipments to and from major ports and other coastal cities. Rather than have containers drayed from a major port area such as Hampton Roads to another major coastal city, it would be possible to move them by barge. Some barge movements on containers already occur on the East Coast between Boston and New York, New York and Baltimore, and Baltimore and Hampton Roads. About one-fourth of respondents to the AAPA survey think that relying more heavily on barge shipments would help reduce landside congestion (Table 3-2).

Barge movements may also offer some advantages at some specific locations, such as between New York's Red Hook Terminal in Brooklyn and rail terminals in New Jersey. Increased barge shipments could also reduce some truck traffic and air pollution. In New York's case, it would help reduce truck operations on already heavily congested roads serving Red Hook Terminal and provide some relief during the rehabilitation of a major expressway that links Red Hook Terminal with New Jersey. Similarly, the Port of Sacramento has proposed a heavier reliance on barge transportation between its terminals and those of the ports of Oakland and San Francisco. The idea is to have containers shuttled on barge for the 79 mi from Sacramento to the bay. This would reduce the congestion on Interstate 80, the number of trucks using the bay bridges and vehicle emissions. Although only in the conceptual stage, this proposal is supported by the California Department of Transportation and many major motor carriers and may ultimately prove to be a cost-effective solution to congestion and air-quality problems in the Bay Area.

The general demise of shipping along the U.S. coastline in recent years has weakened domestic shipping between major cities on the same coast that are too distant to rely on barges. For example, marine transportation of domestic trade between New York and Miami is made difficult by federal prohibitions on shipments of domestic goods

and operating U.S.-built ships that would not fall under these prohibitions. The loss of subsidies for ship construction has virtually ended the manufacture of commercial container ships in the United States. A recent study by the Transportation Research Board notes the many problems in marine container shipping associated with federal policies and calls for a major reevaluation of federal policies governing the merchant marine and maritime industries (TRB 1992).

Summary

Some ideas for responding to port access problems are not conventional highway projects, but they could be funded in part from the Highway Trust Fund. Ports are already pursuing a variety of strategies for resolving their access problems:

- Dedicated freight corridors between terminals and major rail and highway connections are being planned by several major ports; these corridors could divert truck traffic from local streets and thereby reduce congestion and neighborhood opposition;
- More use of on- or near-terminal rail service could also reduce truck traffic on local streets;
- The development of intermodal terminals many miles inland from the waterfront could also divert through truck traffic from congested urban highways; and
- Greater reliance on barge or intercoastal vessel shipments could reduce truck traffic between some marine terminals and other coastal cities.

The success of the first three of these efforts will depend in part on reducing the congestion caused by at-grade rail-highway crossings. Although the Intermodal Surface Transportation Efficiency Act (ISTEA) does not mention these issues explicitly, it clearly encourages greater reliance on the existing intermodal transportation system for the movement of people and freight. The ISTEA also encourages more reliance on toll facilities and is much more permissive in the uses of toll revenues than previous legislation. Use of such revenues to develop intermodal facilities such as barge terminals could help reduce truck traffic on already-congested roadways. *The committee recommends that FHWA*

recognize the spirit of intermodalism and flexibility for states in the ISTEA in approving project proposals such as those listed.

REFERENCES

ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
TAMS	TAMS Consultants, Inc.
TRB	Transportation Research Board
TTI	Texas Transportation Institute

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4

Land Use

The waterfront land of cities on navigable waterways may be the cities' most valuable physical assets, and for many cities they have been fundamental to urban renewal. Many cities have redeveloped their waterfronts with parks, stores, hotels, and condominiums. As a result, ports are experiencing more competition for waterfront land, port access roads have become more congested by the cars of tourists and shoppers, and old and new neighbors are attempting to restrict the noise and rail and truck traffic generated by ports. Some opportunities can be used to keep these developments from restricting port access in the future. The Intermodal Surface Transportation Efficiency Act (ISTEA) allows for the preservation of rights-of-way along transportation corridors; some states and municipalities are actively protecting maritime uses through protective zoning; congestion management techniques can be used to keep traffic from clogging port access routes; and ports can work more actively with local and neighborhood groups to resolve their differences.

IMPEDIMENTS

only part of a much larger trend. Residential and nonmaritime commercial development has been occurring along nearly every urban shoreline. Boston, New York, Philadelphia, Jacksonville, New Orleans, Portland (Oregon), Detroit, and Milwaukee have transformed their waterfronts (Mayer 1988). In other cities, such as Seattle, the natural and scenic advantages of waterfront development have led developers to compete with the port for scarce land without as much deliberate city involvement but with some effort by the city to protect maritime uses.

Ports depend on their access to water to conduct a vital business, but the public wants to be near the water for other reasons: "It is a source of renewal and refreshment adjacent to the busy urban grid. It provides visual release from the tension caused by dense urban images. It offers exotic experiences that are aesthetic, educational, and dramatic..." (Hershman 1988). People will pay a premium to be near the water, which increases the value of waterfront land. Just as most central business districts have become dominated by office towers—because they have the highest earning potential per acre of any form of development—waterfront land will be sought by developers who can offer the "highest and best use" by developing office towers, condominiums, or hotels (Goodwin 1988). Pressure on local land use decision-making bodies from developers is intense, and the argument that land use decisions are governed by the marketplace, though rarely accepted completely by land use planners, usually outweighs other considerations in the land use decisions of most communities.

As a result of gentrification, the increased value of land that could be used for port-related activities can be out of the reach of ports as well as some of their users, such as the trucking firms that serve port terminals. For 74 percent of the ports in the American Association of Port Authorities (AAPA) survey, competition for the available land has increased in recent years (Table 4-1). The problem appears to be most prevalent among container ports, apparently because most of them are surrounded by more intensely developed urbanized areas (Table 4-1). Growing land values and the competition for scarce land have restricted the development of landside access improvements at 31 percent of all ports and at 44 percent of container ports (Table 4-1).

Goodwin (1988) describes the issue of waterfront development as a choice between alternative views of the urban waterfront. In one

TABLE 4-1 Land Use Impediments Identified in AAPA Survey

Impediment	All Ports (n = 54)		Container Ports (n = 25)		All ((n =
	No.	Percent	No.	Percent	No.
Increased competition for land	40	74	21	84	19
Restricted access improvements due to increased competition	17	31	11	44	6

development officials—the waterfront is seen as an extens central business district. The traditional maritime indus some coastal-zone management proponents hold the sec that the waterfront is seen as a "unique district where acti amenities derive from the contiguity to navigable water" (1988, 290).

Land use decisions are largely the domain of local gov but comparatively few natural harbors (or waterfront area be developed into harbors) are suitable for oceangoing ve United States, its economy so dependent on imports and ex scarcely afford to let nonmaritime development pressures c dominate the future of harbor waterfronts. Some ports, suc Orleans, Philadelphia, Tacoma, and San Diego, have ampl expansion, but, given competing demands and rising la around other major ports, will there be enough for the long

Examples

The ports of Seattle and Tacoma handle most of the contai in the Pacific Northwest. Seattle's port is in a constricted a city with limited room to expand. The port depends on staging and storage areas, at which containers are stored te loaded, or unloaded. These areas require a good deal of

promoted the commercial development of land owned by the port. Although the port has been active in redeveloping Jack London Square, it has resisted some of the city's efforts for fear that they would undermine the port's long-term competitive edge (*Journal of Commerce* 1988). However, according to port officials, the current commercial development next to the Port of Oakland, as well as the recreational uses resulting from a nearby marina, do not greatly disturb port operations. Competing demands have occurred at the Port of San Francisco as well, where the port's land holdings have been viewed by some local officials as far more valuable than the port itself (Gilliam 1980). Shipping in San Francisco has diminished while tourism and commercial and residential development have increased. A $3 billion, 20-yr residential and mixed use development occurring adjacent to the port will clearly affect its operations. The only rail line serving the port runs through the land to be developed.

At the Port of Richmond (California), which handles liquid bulk cargoes, a 5,000-unit residential development has grown up within a quarter-mile of the port in an area formerly zoned for industrial uses. The port lost a lucrative opportunity to develop a cement terminal and lost use of a liquid bulk terminal because of resident opposition. The continued development of residential areas near potentially hazardous refineries and liquid bulk facilities implies growing constraints on the port's operations.

A theme park proposed by the Walt Disney Company alongside the Port of Long Beach also raised a controversy over commercial development that might have affected the port. The city supported the economic benefits of the park, but a successful theme park may have clogged the access routes to the port.

On the Gulf Coast, in contrast, the Port of New Orleans, which has undeveloped land that it could use for bulk terminal operations, has been an active partner in developing port waterfront land that no longer has maritime uses. Port officials hope that the revenues from these developments will support other maritime initiatives (Knack 1991; *Journal of Commerce* 1988). At the Port of Galveston, however, residential and commercial areas back up to port property. Port officials express some concern over a major waterfront development project in close proximity to the port's container terminal.

Ports serving cities in the Northeast face considerable land use

town Navy Yard have been booms for the city's coffers, but truckers serving Boston's port complain about the heavily congested roads that are due in part to increased tourist traffic. They also complain that high land costs make it harder to find space for truck operations, particularly parking (*Journal of Commerce* 1988).

At the Port of New York and New Jersey, competing land uses and rising land costs, combined with changes in transportation logistics, have long been forcing changes in port activities. The many finger piers along the shores of Manhattan, Long Island, and Staten Island have been rendered obsolete, and some have become prime sites for urban waterfront restaurants and proposed developments (Wagner 1980; Moss 1980). The port still has a main terminal in Brooklyn (Red Hook), where considerable conflict occurs along the Brooklyn waterfront between maritime and other commercial interests. The Port of New York and New Jersey has other terminals in New Jersey: the Port Authority Marine Terminal in Elizabeth, Port Newark, and the Global Marine Terminal in Jersey City, which is owned by a private terminal operator. These terminals are surrounded by wetlands, and alternative land is expensive. Nonetheless, the port owns adjacent land that could be used for container marshaling if on-dock facilities were built. Even on the New Jersey side, where land is less expensive than it is in New York City, rising land values are affecting the warehousing industry. According to a report of the Port Authority of New York and New Jersey (undated), as land values escalate around the port's terminals, warehousing operations move farther away, thereby increasing the cost of drayage and making service to the greater metropolitan region from competitive ports more attractive.

Although many ports in urbanized areas are concerned about encroaching development, some ports report few problems. In contrast to the problems at New York and New Jersey and Boston, for example, the Port of Philadelphia has plenty of land for future development. Philadelphia may also have a unique advantage; it has legislative authority to veto zoning changes approved by the city of Philadelphia that the port authority concludes are not in the interest of the port. The ports of Memphis and Chicago also have ample land. Because of the declining seagoing trade serving the Great Lakes, Chicago's port is actively promoting nonmaritime uses of its land. Memphis, in contrast, will sell its land only to industries that need access

Problems of Land Use Planning and Implementation

Many port officials have problems apart from rising land values: they may discover that a road serving the port becomes congested because development is permitted along its access road. The increased traffic adds to travel times and costs for trucks serving the port, which ultimately leads to higher transportation costs. From the ports' perspective an incompatible land use has been permitted that increases their costs; in the highly competitive port industry, this can mean lost commerce for the port and lost tax revenues for the community.

Deciding whether more stringent land use controls could avoid such problems requires some background on the tools available for implementing land use plans. The two distinct tools for carrying out land use plans in the context of port access are zoning and transportation planning.

Zoning

Land use plans guide the development of land in a county or municipality; zoning applies to specific parcels. Plans are usually considered advisory; zoning decisions are binding, although they can be and often are appealed in court (Kelly 1988).

Zoning is the basic tool for implementing a land use plan; it regulates the land uses permitted within zones. Such uses might include the types of activity, density of development, and sizes of buildings. Most municipal zoning laws rely on four kinds of zone: residential, commercial, industrial, and agricultural. Some zoning laws and practices allow mixed uses, but they restrict them in the following ways: residential development is allowed in commercial and industrial zones, but commercial or industrial development is not permitted in residential zones. Commercial development is allowed in industrial zones, but not vice versa. Hence, in zoning systems of this type, developing a commercial property that would compete with a port for available roadway capacity could not be prohibited. In addition,

government, zoning as it has traditionally been practiced c
but not prescribe, development. "No matter how good or h
tive the zoning of a particular community may be, landowne
opers, and individual citizens still make a variety of decis
heavily influence, if not determine, the final land uses of the
nity" (Kelly 1988, 283). When specific interests are brough
on a zoning commission, which might include the landown
to maximize land value, the developer's aim for the most p
venture, the local government's support for investments tha
the tax base, and the consumers' interest in certain kinds of
ment, the potentially negative impact of increased traffic c
has not always loomed large. (Recent municipal elections
cities, however, have revealed the influence of neighborhoo
whose frustration with incumbents was driven partly by co
about traffic congestion.) Whereas land use plans are de
minimize the adverse social effects of development, zoning c
specific parcels, and the focus of zoning variances on specif
often criticized fairly for failing to consider the broader im
that are often part of the general plan (Jackson 1981).

Transportation Planning

The provision of transportation facilities also directly affect
decisions. However, land use and transportation plans ha
been well coordinated, largely because the relationship be
two is complex and changing.

> Two factors contribute to the complexity of the land use–t
> tion equation. First, the relationship between transportation
> use is reciprocal: land use patterns affect travel decisions,
> decisions affect land use patterns—perhaps simultaneously
> sequentially. Second, the activity patterns of business an
> change, independently of land use and transportation, in re
> changing values, norms, and preferences. (Rosenbloom 198

At the metropolitan level, then, it has long been difficult to
use and transportation plans because land development spaw
ticipated demands on the transportation system and the pr
major transportation corridors spawns unanticipated den
land use. At the level of individual developments or minor

has long been difficult for local communities to resist site developments that promise additional growth, even when the local officials are aware that the new development may congest the routes serving it.

With the recent constraints on public budgets, transportation planners have minimized the need for public investment by relying more heavily on transportation system management (TSM) techniques and, in some states, by requiring greater private investment in transportation facilities when the site development may increase traffic congestion. TSM includes a wide variety of techniques such as promoting vanpools and designating high-occupancy vehicle lanes in major corridors. Efforts to require greater private investment are used less but growing in popularity with local governments. States such as Florida and California, for example, permit local governments to require private developers to pay impact fees to fund the added transportation facilities needed to serve their developments (Rosenbloom 1988; Nelson 1988).

Public acquisition of land to keep it from being developed is another option, but an expensive one. Opportunities for land banking and corridor preservation are reviewed later in this chapter.

Examples

The U.S. Department of Transportation (DOT) study team found an example in which development added congestion to an access road in Galveston. After much effort and consensus building among the Chamber of Commerce, Galveston citizens, the county, and the state, a new access road, Port Industrial Boulevard, was built to serve the port and to keep truck traffic out of residential areas. Since then, a new medical trauma center has been built that depends on the road, and the route has become popular with employees at firms on Galveston Island. Although the road benefits these users, their increased use of it is causing congestion. Another example of development on a port access road occurred in New Jersey, where the successful development of a major discount outlet was permitted on a site next to the

Neighborhood-Port Conflicts

Background

Many urban ports abut residential areas, and the interests of the ports often conflict with those of its neighbors because the land uses are incompatible. Landside access issues bring this friction to the fore because the ports' needs for moving cargo can increase truck and railroad traffic, noise, dust, odors, and congestion, which the neighborhood resists. Efforts to reduce traffic conflicts by extending the ports' hours of operation (to avoid peak-hour commuting traffic) can also meet with neighborhood resistance.

Recent years have seen a renewed interest in preserving urban and historic neighborhoods, but the value and importance of neighborhoods has long been realized:

> Throughout this century, the neighborhood has been a major focus of attention among those concerned with urban affairs. This focus on neighborhoods stems from the belief that they represent the building blocks of the city. The health of a city is largely dependent on the vitality of its individual neighborhoods, and the physical and social conditions in neighborhoods to a large extent define the quality of life for urban residents. They affect individual decisions to stay or to seek more desirable living conditions in suburban or rural locations. Those decisions, in turn, affect the local tax base and the overall viability of urban areas. (Rohe and Gates 1985)

Concern about preserving neighborhoods has been accompanied by growing involvement of neighborhood groups and residents in local planning and in local politics (Rohe and Gates 1985). Many cities have established formal and informal programs for working directly with neighborhood groups and integrating their concerns into planning and decision making. Neighborhood concerns, however, can restrict the options available to seaports, because neighborhood groups often resist transportation projects that result in the relocation of families or elevation of noise and congestion.

The Century Freeway project in Los Angeles is admittedly an extreme example of the ability of neighborhoods to delay a project and force concessions, but it is still useful as a cautionary tale of the potential consequences of ignoring neighborhood concerns (Kagan

Allowing residential areas to develop close to port complexes often results in neighborhood efforts to reduce the traffic, noise, and dust stirred up by port activities.

Los Angeles International Airport with communities to the east was delayed for the first time in 1972, partly as the result of a lawsuit filed by a community at the behest of an active neighborhood group. The project, initially estimated to cost $500 million, has ballooned to more than $2 billion and is still unfinished more than 20 years after it began. Costs added because of neighborhood and community pressure include a light rail line, sound walls, and 3,700 housing units to replace the 6,000 units taken in the development of the highway.

Successful port landside projects have gone forward, however, even in the greater Los Angeles area—for example, the construction of the 150-acre Southern Pacific Intermodal Container Transfer Facility, which serves the San Pedro Bay ports. This project succeeded for several unique reasons: (a) the Port of Los Angeles had owned the site since the 1920s, (b) the Southern Pacific Railroad had a rail line leading to the site, and (c) a lightly used 4.5-mi freeway, built by the federal government for the military in the 1930s, already connected

was also boosted by Congressman Glenn Anderson, then the chairman of the powerful House Public Works Committee, and it did not initially meet significant opposition from the communities and neighborhoods along the way (Kagan 1990, 140). When the city of Carson did begin to oppose the project, the ports and Southern Pacific agreed to fund additional improvements and sound barriers at an initial extra cost of $5 million. By acting quickly, making concessions, and paying for specific improvements to mitigate community opposition, port officials were able to keep the project from becoming sidetracked.

The problems that ports encounter with neighborhoods and residents are usually of a smaller scale than the Century Freeway, but they can still be difficult and expensive to resolve. For example, a low-income neighborhood of about 475 homes is next to the Port of Stockton. One access road serving the port, which a substantial share of the truck traffic serving the port uses, passes through the middle of this neighborhood. Improving the existing access route, however, would require relocating many families. Although expensive, this strategy has been used successfully for an entire neighborhood that agreed to be relocated to make way for an expressway interchange (Rohe and Mouw 1991). But when the news leaked that the Stockton port was considering acquiring the property and relocating the residents, it generated strong resistance from the neighborhood and from city and county elected officials. Attention has now been focused on improving an alternative but more circuitous route that would bypass the neighborhood.

Examples

Neighborhood issues are not new to most urban ports. In the 1970s Seattle's port found that affluent neighborhoods could resist its efforts to expand a terminal into a larger-scale operation (Hershman 1988, 5). Efforts to resolve the Port of Pensacola's landside access problems and to expand the port have long been stymied by the opposition of

but this may be resisted by the neighborhoods surrounding the proposed corridor. Boston's port has been reluctant to push for the improvement of the spur rail lines serving the port because port officials know it would bring neighborhood opposition. Neighborhood involvement in planning—and fighting redevelopment plans—has a long history in the city (Donaher et al. 1980). Boston's terminals are next to neighborhoods that are unhappy about the amount of truck traffic on local streets; the lack of an alternative truck route has caused tensions between the port and its surrounding neighborhoods.

The Port of Sacramento currently has an unresolved conflict with an adjacent community. The railroad tracks entering the port area from the north traverse a residential area with many grade crossings. The residents, concerned about the risks from an accident involving hazardous materials, have begun pressuring the city to restrict traffic and relocate the tracks. The city has responded by restricting development of rail users in the port area and by initiating a study to determine whether the tracks can be relocated. The city's restrictions on development are delaying more than $15 million in industrial development in the port area.

Port operations are often affected by incompatible land uses when residential areas adjoin port property. Dust stirred up by loading commodities such as coal, petroleum coke, and gypsum and the odors from some liquid bulk products were cited as sources of neighborhood complaints at several major bulk ports. Responding to these kinds of problems costs ports money. The Port of Long Beach, for example, has invested in expanding its petroleum coke handling area in order to store more of the commodity under cover to minimize dust. Sometimes the costs are in restricted options or lost opportunities. As mentioned, the Port of Stockton lost opportunities because of neighborhood opposition. The Port of New York and New Jersey gave up handling anthracite coal from Pennsylvania because the cost of covering the commodity would not be recouped. Baltimore cannot handle some dry bulk commodities at its terminals that border on residential areas. Many other examples can be cited.

neighborhood opposition to increased port operations reduce the ability of port officials to resolve landside bottlenecks. Moreover, control over these issues resides at the local level, where local interests often predominate. Local development pressures for waterfront land are intense for the "highest and best use," which may result in the development of condominiums at the expense of container staging areas; zoning (as traditionally practiced) to inhibit inland development along access routes is an imperfect tool for regulating land use. Moreover, land use planning and zoning are the prerogative of local government, which state and federal authorities have rarely overridden. Despite these difficulties, port officials have opportunities to influence local decision making to protect port and maritime interests.

Land Banking and Corridor Preservation

Over the years many ports (or other public authorities) have bought sites when land uses by other maritime tenants were no longer economic. Some of the sites have been redeveloped for nonmaritime uses; others have been reserved for port terminals and the like. Boston and New Orleans, among other ports, have used the commercial developments to cross-subsidize maritime-related projects. Goodwin (1988) considers fee-simple land purchase the best approach to banking land for marine use, but the cost of the land and the availability of funds are major considerations. An alternative to paying the full price for the land is to buy the development rights (the difference between the cost of the land at its current use and at its highest and best use), but this approach is still expensive. One way local governments can minimize the immediate budget consequences of such purchases is to pay landowners in increments over several years.

Abandoned rail corridors are prime candidates to be bought and reserved for future transportation use. It is important to preserve the corridor as well as rights-of-way along highways that may need widening in the future. Preserving the rights-of-way can be greatly aided if state highway agencies are given the right to acquire the land and restrict its development. Land for corridors and rights-of-way can be preserved through official maps and subdivision regulations, but programs must be designed carefully: the rights of landowners as defined

require state-enabling legislation and careful administration to avoid legal challenges. Kolis and Mandelker (1987) outline the basic approaches for a model program that would withstand legal challenges. Although ports that are already surrounded by an intensely developed urban environment may have little opportunity to preserve corridors, opportunities still exist to preserve land for future transportation needs at smaller ports and at possible sites for future inland terminals and the corridors to serve them.

The 1991 ISTEA makes specific provision for right-of-way acquisition (Section 1017) and calls on the Secretary of Transportation to report to Congress in 1993 on potential corridors identified for preservation (Section 1018). The act provides that state expenses for right-of-way purchased before a project is approved for federal funding will be reimbursed once a project is approved for federal funding, if the state follows specific guidelines and adheres to federal law on acquisition and relocation.

The ISTEA indicates the national concern for corridor preservation by requiring the Secretary to report on an inventory of candidates for preservation that are to be identified by metropolitan planning organizations (MPOs) and the states. As outlined in Sections 1024(f) and 1025(c), the MPOs and the states are to develop transportation plans that include several provisions important to port access: "access to ports" and "major freight distribution routes." The act also requires "preservation of rights-of-way for construction of future transportation projects, including identification of unused rights-of-way which may be needed for future transportation corridors and identification of those corridors for which action is most needed to prevent destruction or loss." [Section 1024(f)(7) and (10) relates to planning by MPOs, and Section 1025(c)(4) and (17) contains similar language for states. See also Section 3012(f)(7,8,10,11).] *The committee recommends that MPOs encourage preservation of right-of-way, potential transportation corridors, and waterfront land in their long-range planning.*

Protective Zoning

Land uses can also be restricted through special zoning. In Massachusetts, for example, commonwealth law specifies waterfront land uses to be protected for industrial maritime uses and recreational

concern (MASS. GEN. LAWS. Chapter 91). The primary tool for enforcement is the Waterways Licensing Program, which was formally established in 1866 but dates to the colonial period. The program is currently administered through the Massachusetts Department of Environmental Protection, which has the authority to license activities on tidal lands that would affect the environment, and its provisions are incorporated into the commonwealth's Coastal Zone Management Plan.

The plan, based on language in Chapter 91, designates 12 port areas in the state that have the following characteristics:

- Navigable channels 20 ft deep or more at mean low water,
- Tidelands and associated lands abutting such channels that are suited to accommodate maritime-dependent industrial uses,
- Availability of well-developed road and rail links leading to major truck and arterial routes, and
- Availability of water and sewer services capable of supporting maritime-dependent industrial uses.

This designation ensures that areas of special physical and operational requirements dependent on access to navigable channels are not impaired by other development. To regulate the land uses, municipalities must enact complementary zoning ordinances. The city of Boston, for example, has a Municipal Harbor Plan; it was amended in 1989 to create a maritime economy reserve (MER) district with provisions that expand on the statewide policy (City of Boston 1990). Specifically, the MERs are restricted to industrial maritime activity; the strength of these regulations is made obvious by the lack of variances permitted. The zoning regulations allow only specific maritime land uses within the MERs, but they also provide for other maritime uses within the designated port areas that are less restricted. These other maritime uses include such activities as marinas and recreational boat repair facilities. Such zoning reduces the ability of developers to pursue nonmaritime land uses. *The committee recommends that states, coastal zone management agencies, and local governments develop similar zoning regulations and ordinances where appropriate.*

Congestion Management

Some transportation planning techniques can be used to mitigate the

adjacent to port terminals or along access roads (Rosenbloom 1988). A variety of traffic engineering changes can be made to individual corridors that become congested. Traffic throughput can be increased by such procedures as designating one-way streets, imposing turn restrictions, widening the street to add extra lanes, and better coordinating traffic signals. Efforts can also be made to reduce automobile traffic by encouraging van- and carpools and by improving transit schedules and routes.

Besides applying a wide variety of traffic management techniques, and as a means to fund them, greater private investment can be required in exchange for permitting development. Since the 1970s many municipalities have begun imposing impact fees on development projects that make new demands on public infrastructure and schools (Draper 1988; Nelson 1988). The example of Manatee County, Florida, is instructive: since the mid-1980s, new development in the county must pay for additional roadway capacity caused by increased traffic generated by the project in order to maintain the Institute of Traffic Engineers' Level-of-Service C; the fee is based on average construction costs (Barnebey et al. 1988). The county earmarks the revenues earned for roadway improvements in the section of the county in which the development occurs. The imposition of such fees has passed several court tests in states such as California, Colorado, Florida, and Oregon, but they work best in states that have passed enabling legislation (Nelson 1988).

A new California law (Proposition 111) that requires congestion management planning is an example of a governmental response to the degraded air quality and delays caused when demand exceeds supply. For each corridor, a base level of capacity is to be established. When new projects produce additional demands that degrade service below this level, they must be corrected by expanding the roadway, introducing traffic management techniques, or downsizing the development. If local jurisdictions do not develop congestion management plans, they could lose their share of the increased state aid made possible by Proposition 111.

The ISTEA (enacted after Proposition 111) also requires states and MPOs to develop congestion management systems [Sections 1024(i) and 1025(h)]. These systems are not described in any detail in the legislation, but they are clearly meant to encourage reliance on the existing intermodal system to the extent that doing so is practical.

air standards. The requirement for greater planning to a
tion can be a device for ports to use when they are co
project development along a key corridor serving the
come congested because of the development. *The comm*
mends that congestion management techniques to main
freight movements on port access routes be incorporated
tion management plans.

Working with Neighborhood Groups

Many cities and communities address the concerns of n
groups through hearings or public meetings, but some la
are too complex to be resolved in that way alone. Some l
tions have developed a tradition of extensive citizen a
hood involvement in major issues of transportation pla
for major development projects in these cases can includ
with dozens of groups, many meetings, and extensive r
commentary on plans by community residents. The citiz
borhood involvement in the extension of the Washingto
transit system through Arlington County, Virginia, pro
study of constructive community involvement (Parker 19

Effective resolutions to complex land use issues, thoug
a smaller scale than a subway line, are also being achieve
through multiparty negotiations. These negotiations typ
the project developer, city officials, and affected gr
1989). The models developed for these complex neg
varied, but they have some common features: they re
face negotiations and neutral facilitators, include all p
legitimate interest, mandate that all parties agree on the
rely on consensus decision making (Fulton 1989, 2). S
tions are difficult and time-consuming, but once achie
result in decisions that reflect the interests of all grou
future confrontations in court or in the political arena.
a neighborhood group that is adamantly opposed to a p

ties. The developer could proceed less concerned about future efforts to stop or delay the project. When major redevelopment plans are being considered for ports, port officials can make early overtures to the affected neighborhood groups to ensure that their views are incorporated into the design. Although working with neighborhood groups early in a project may require the ports to accept landside projects that are less than ideal, it may allow projects to move forward that would otherwise be blocked by political or legal opposition. *Port officials can advance their causes by working more closely with neighborhood groups and local planning officials while they are planning their improvements to develop and negotiate projects more acceptable to all parties and to help avoid litigation by groups opposed to such projects.*

Summary

The options suggested in this chapter require port officials to be adept at municipal and state affairs, but this is not new. Many ports are a branch of a municipality, a special district within a municipality, or an arm of state government. Port officials, however, should become more involved in influencing areawide land use and transportation decisions and in working with neighborhood groups during the planning phase to help avoid future conflicts.

Specific provisions in the ISTEA provide for better planning to preserve key corridors, purchase rights-of-way, and avoid increased congestion. As discussed in Chapter 7, the ISTEA makes some fundamental changes in the process of planning, selecting, and funding projects that will place even greater emphasis on port officials in metropolitan areas becoming more involved in regional transportation planning.

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5

Regulatory Issues

The growing array of complex, sometimes conflicting, federal, state, regional, and local environmental and safety laws and regulations affects the efficiency of port operations and the ability to improve access constraints. For port officials, the most pressing aspects of this problem are the regulations on the preservation of wetlands. Additional concerns about air quality and proposals for restricting truck operations, though not yet imposed, suggest complicated problems that ports may be required to contend with in the future. Dredging and disposing of dredged materials have a more direct effect on waterside access to ports than on landside access, but the disposal of dredged materials can also influence efforts to reconfigure terminals. Having hazardous materials on port property or in transportation corridors, and moving such cargoes, can also pose risks to public safety. In addition, many port officials express concern about conflicting state and national regulations governing the loaded weight of trucks serving the ports.

CONSTRAINTS

Wetlands Preservation

assessment of the effects of significant Federal transportation actions or Federal-aid projects on the environment, special attention to air pollution, and protection of wetlands and coastal zones. . . . The Department of Transportation must continue to coordinate with other agencies to ensure timely and effective environmental review of transportation projects built or funded as part of Federal programs, and to see that Federal environmental policies are reflected in transportation programs and decisions. . . . The Department of Transportation, in coordination with other agencies, is developing guidelines for carrying out the "no net loss" goal with respect to the effects of transportation on the Nation's wetlands. (DOT 1990)

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 makes clear the priority that Congress places on environmental goals. As declared in the first paragraph of this legislation, "It is the policy of the United States to develop a National Intermodal Transportation System that is economically efficient and environmentally sound . . ." (Section 2). Later in that section, the act requires "particular attention to the external benefits of reduced air pollution, reduced traffic congestion, and other aspects of quality of life."

Many, if not most, Americans support these goals. Many port officials, however, note that the current environmental regulatory process can mean long, costly delays. As the American public has become more aware of the depletion of its most valued environmental resources in recent years, federal provisions protecting wetlands and coastal areas have been toughened and enforcement of existing regulations has been strengthened. Existing laws and regulations include the federal Clean Water Act's permitting program (Section 404), a memorandum of agreement on mitigation between the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE), and provisions in the federal Coastal Zone Management Act of 1972. Other federal and state agencies are also involved in protecting wetlands. COE is required to weigh the environmental concerns raised by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service as well as the environmental concerns raised by state and regional agencies.

The land development process involving wetlands is cumbersome and time-consuming:

Not surprisingly, many of the [involved] agencies have rules dealing

tal protection or resource allocation objectives. The result is th
lar principles of coastal management are espoused, but t
implemented differently to the consternation of permit app
Most of the agencies, for example, are protecting wetland
mizing landfill in water areas, encouraging only necessary
dependent uses to encroach on the water . . . requiring mi
where there is an unavoidable adverse impact on aquatic re
and promoting public access whenever possible. But the agen
differ on such matters as the definition of wetlands, the justi
for fill, the definition of "water dependency" and the appropri
and amount of mitigation or public access. . . . Ports and othe
developers are faced with a maturing regulatory framework,
that does not yet provide predictability or consensus. Becaus
case-by-case review structure, the conflicting standards of rev
differences among coastal environments, and the inadequate l
tween long-range plans and individual permit applications, the
of permit battles on individual projects will continue. (Hershn
Kory 1988, 111–112)

Many changes in wetlands regulatory and nonregulatory
have been proposed by the Bush administration. The adminis
continues to endorse the "no net loss" goal, advocates increa
quisition and restoration of wetlands on federal land, and,
several other changes, supports increased research and trainir
eral changes have been proposed to reduce the delays in re
permits:

- COE would be responsible for all meetings and contacts v
public on behalf of the applicant and other agencies;
- Permit applications not acted on in 6 months would be
ered approved;
- Use of general permits would be expanded;
- Consulting agencies would be required to provide site-
information when commenting on individual permits, and
would be based on resources or issues of national significance;
- States and localities would be encouraged to assume larg
including the use of regional and state general permits an
flexible state assumption of Section 404 permitting.

In addition, the administration has proposed substantial re
to the procedures used to classify wetlands. Comments on

changes to the manual for delineating wetlands were requested by notice in *Federal Register* of August 14, 1991; these changes are designed to clarify the definitions and assessment procedures that can be used to classify land that is part of a wetland or wet for only part of the year (*Federal Register* 1991).

At this stage it is impossible to predict the outcome of these proposals and their effects on port landside access. Some of the changes proposed in the wetlands delineation manual have been met with alarm by some environmental scientists and environmental groups, which have charged that the revised procedures prescribed for delineating wetlands lack a scientific basis (*Washington Post* 1991). State wetlands managers have welcomed the proposals designed to streamline the permitting process, but they have also complained that some of the revised delineation procedures are "illogical and unusable" (Association of State Wetlands Managers 1991). Even as these issues are debated in the media and in comments to the docket (and will probably continue to be debated in future litigation), legislative proposals have been made to reauthorize the Clean Water Act, which is due to expire in 1992. Several bills have been proposed in Congress with a definition of wetlands substantially different from that proposed by the administration, and other bills propose to change the Section 404 permitting process significantly. The continuing controversy over protecting wetlands and the pending reauthorization of the Clean Water Act suggest that a more streamlined permitting process is unlikely to emerge for some time.

Examples

In examining the impact of environmental regulations on landside access, one must recognize the importance of land availability to modern container ports. Even a small to medium-sized container terminal with 6 to 10 berths would require 200 to 400 acres of land on or near the waterfront; very large terminals can require 2,000 to 3,000 acres. Marine container terminals provide not only loading and unloading facilities and equipment but equally important container storage and staging areas. Container storage yards are necessary because very few outbound containers can be dispatched immediately after arriving at the terminal, and very few inbound containers can be picked up immediately after coming off a ship.

Container storage areas require scarce urban waterfront land. This design minimizes the demand by stacking containers instead of r each container on a truck chassis (*photograph courtesy Port of Seatt*

Container staging areas are required to consolidate and cont some bulk cargo that arrives at the ports by boxcar or tr shipment.

The need for land and for new intermodal connections container operations is largely driven by the rapid technology in containerization outlined in Chapter 2. In heavily urbaniz land is at a premium, and reconfiguring available space to pro rail and highway connections and to provide container stag storage areas is a complex problem. Because bulk commod dling has not undergone the same technology changes in recer and because bulk terminals tend to already have direct connec rail heads and to pipelines, bulk terminals have less demand land and less need to improve connections in response to demand.

To compete for intermodal freight, most West Coast po brought rail lines closer to marine terminals, sometimes into th nal. Many East Coast ports are trying to do so as well. On- terminal rail service reduces the distance that containers must b from ship to rail, which improves port productivity but c scarce land. In addition, because many inbound containers ha

for trucks to enter and exit and space for them to maneuver.

Much of the available land around the ports could be designated as wetlands (depending on the definition recommended by the administration in pending revisions to wetland regulation) and therefore would be protected under regulatory programs, with a direct impact on port access. For example, at Hampton Roads, where approximately 80 percent of available land is classified as wetlands, the Virginia Port Authority is interested in developing a 2,500-acre site into a terminal, but it may not be able to because environmental regulations discourage disturbing shallow-water seabeds. Similar problems have impeded improvements in land access to another terminal that would be accomplished by filling in some drainage ditches and using some undeveloped areas to dispose of dredged material. The ability to expand terminals is constrained at many ports for similar reasons. Fifty percent of the ports surveyed by the American Association of Port Authorities (AAPA) note that there is a problem. Twenty percent of surveyed ports report that wetlands regulations usually or always impede landside access, and 30 percent report that they sometimes do (Table 5-1). Officials at the Port of Tacoma estimate that waterfront development requires the port to deal with 39 separate approvals in state government and 37 in the federal government.

Because practicable nonwetland alternatives are rarely available to seaports contemplating expansion, the permitting process under the Clean Water Act, Section 404, generally focuses on negotiating a compensatory mitigation package. Although mitigation is also discussed as an opportunity for dealing with environmental regulation, it is important to recognize that this process requires consensus of the various federal and state resource agencies, and resolving differences has often taken much time and effort from port applicants.

Seaports have been engaged in mitigation efforts to offset or compensate for unavoidable loss or damage to wetlands for some time. Reviewing several efforts by seaports reveals the difficulties involved in mitigation (Wessel and Hershman 1988):

- Lack of standardized methods for quantifying the value of environmental resources and thus measure the progress of mitigation,
- Insufficient understanding of ecosystems and how to replicate

Constraint	All Ports (n = 54) No.	Percent	Container Ports (n = 25) No.	Percent	All Oth (n = 29 No.	
Wetlands regulations impede development of access improvements						
Usually or always	11	20	6	24	5	
Sometimes	16	30	8	32	8	
Regulations in place or proposed to restrict rail or truck operations	5	11	4	16	1	

• Resource agency shortcomings, such as lack of goals or ment about goals and inadequate enforcement and monitoring.

The problems with mitigation that seaports have encounter characteristic of mitigation efforts in general; wetlands miti and restoration is an emerging field with a modest research base lack of understanding about how to design, implement, and ev the success of mitigation efforts (Kusler and Kentula 1990) result of issues such as these, wetlands mitigation is a process f with expense and uncertainty. Despite the technical and sci difficulties, wetlands "mitigation banking" may provide an out future port expansions.

> In this strategy [mitigation banking], habitats are created, resto enhanced prior to their use to fulfill a permit application requir Habitat credits are accumulated . . . which may be charged agai habitat losses incurred by future developments. (Wessel and Her 1988, 282)

Though appealing in concept and discussed as an opportun addressing environmental protection, mitigation banking fac eral obstacles: the cost of buying undeveloped waterfront land such land can be found), the cost and uncertainties associate

Nine-acre wetland built by the Port of Tacoma to help mitigate the environmental impact of developing a marine terminal.

wetlands restoration and enhancement, and the lack of consensus in valuing restored or enhanced wetlands (Wessel and Hershman 1988, 283). [Kusler and Kentula (1990) summarize the current gaps in the science of mitigation and outline a variety of steps that should be taken to improve the management of mitigation and restoration efforts.]

Controls on Operations To Improve Air Quality

The hours of truck operations can be constrained either by neighborhood opposition to noise or by proposals to reduce congestion and the related vehicular emissions that degrade air quality. Noise-related restrictions were discussed in Chapter 4 as a neighborhood issue; air-quality–related proposals are the subject of this section. Right now, 11 percent of the communities surrounding seaports have in-place or proposed restrictions on the hours of rail or truck operation (Table 5-1). It is not apparent from the questionnaire whether these restrictions are designed to control noise and traffic or to reduce emissions.

restrictions are likely to be related to air quality.

Southern California has some of the most severe air-qu
lems in the country; its problems and efforts to deal with th
what many urbanized areas will face. In the Los Angel
percent of the carbon monoxide comes from motor veh
half of the emissions that are sources of ozone (Paaswell
state of California, a regional air-quality district, and lo
ments have proposed far-reaching programs to reduce vehi
sions. One proposal would ban heavy trucks from city str
rush hours to reduce the traffic congestion that contribut
emissions. This proposal has been fiercely resisted by th
industry in California, and although a recent referendum
the ability of local governments to enact such policies,
Coast Air Quality Management District (which covers the
Los Angeles, Orange, Riverside, and San Bernardino) mai
it has authority from the state to control vehicular traffic.

The ban on truck movements on city streets during rush
has been discussed by the city of Los Angeles would disrup
movements from the ports of Los Angeles and Long Bea
for delivery within the city. Although many containers ent
ports can be moved by rail, a large proportion is destin
greater Los Angeles area, which necessitates movement b
the time of this writing, only the city of Los Angeles is co
rush-hour truck ban, but the direct effect on the San Pedr
is unclear. One proposal under consideration in Los Ang
exempt streets that are close to the Port of Los Angeles.
Long Beach is not considering a ban on truck traffic d
hours, so the Port of Long Beach would not be affected
But because trucks coming from both ports operate thro
region, they are bound to be affected by bans on rush-
traffic on city streets (movements on state highways wo
affected). The short time span between the end of the mo
hour and the beginning of the afternoon rush hour woul
enough time for many deliveries to be made. Many sh
receivers of cargo probably would have to operate during
hours. The actual regulations and the possible responses re
ulative; more will be known only when the South Coast
Management District proposes a regulation. With many m
areas around the country failing EPA ambient air-quality

Angeles area with great interest.

Dredge and Fill Operations

The need for dredging to improve the ability of harbors and channels to handle large, modern vessels is mainly a waterside issue, but dredge and fill operations are closely related to port landside development. Throughout the history of port development, ports created waterfront land using fill materials dredged from the harbor. The growing concern for environmental protection, however, has made this process time-consuming and in many cases unworkable, or workable only after great costs. Major federal dredging projects often require more than 20 years of effort to study alternatives, secure permits, and receive federal funding (Marine Board 1985). Contesting local or environmental groups opposed to dredging projects adds still more time; even when the groups do not prevail in court, they can tie up agencies in lengthy proceedings (Kagan 1990). The Port of Oakland's 20-year efforts to achieve a permit to deepen the channel leading to the port from 35 to 42 ft is a case in point.

The time required for dredging projects has expanded in recent years, in part because of disagreements dating to the Carter administration between Congress and the executive branch over funding for major water projects and port improvements (Marine Board 1985). Both the Carter and the Reagan administrations tried to change the long-standing process (which was changed in 1986) by which individual congressional committees selected and funded major port projects.

The complex environmental review and permitting process contributes to the slow pace. The many agencies involved have different priorities and different abilities to oversee complex issues. COE is the lead agency for approving dredging projects and issuing permits, but other federal agencies that take part are the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and EPA. Several state and local agencies are also involved, such as state departments of fish, game, and wildlife; state and regional water quality control boards; and state coastal-zone management programs. When all these agencies' oversight and approval roles are combined, the list is daunting. A major dredging project on the West Coast, for example, required

negotiations with 65 separate offices of the various regulatory agencies. Even though COE has the lead role, environmental regulations require it to "give full consideration" to the comments of other agencies (Marine Board 1985, 86), and EPA can override its decisions. As a result, a process already made complicated by the scientific and technical issues is lengthened by an extensive process for review, comment, and approval.

Buried Hazardous Materials

The concerns about dumping hazardous and toxic materials into port harbors also apply to burying hazardous and toxic materials in port terminal land or in the rights-of-way of transportation corridors serving the ports. State transportation agencies throughout the nation encounter problems with buried hazardous wastes and few agencies are prepared for the scope and cost of those problems (NCHRP 1988).

Hazardous waste, which may be the residue of former industrial land uses on port land, must be managed under the guidelines of a multitude of federal and state laws and regulations. The federal laws include the Comprehensive Environmental Response, Compensation, and Liability Act; the Superfund Amendments and Reauthorization Act; the Resource Conservation and Recovery Act; the Hazardous and Solid Waste amendments; and the worker protection requirements of the Occupational Safety and Health Administration. These laws also establish liability for hazardous waste cleanup, which can include the owner of the land even if the owner had neither a role in depositing the hazardous waste nor knowledge of its presence. The AAPA survey did not include a question about hazardous waste, but the issue did surface in the U.S. Department of Transportation (DOT) study team's visits to individual ports. Two projects in Toledo, for example, include land contaminated with industrial wastes. One project has been delayed by EPA review, and another has been complicated by the presence of benzene in land that the city wants to acquire to provide an overpass that would help solve a transportation bottleneck at the port. Some of the unused parcels available to the Delaware River ports are former industrial sites; the cost of cleanup

Hazardous Materials Transportation

A substantial share of products moving through ports handling bulk commodities are classified as hazardous. At the Port Authority of New York and New Jersey, for example, officials estimate that 12 percent of port vehicles carry hazardous materials of which 40 percent is flammable. In the AAPA survey, 40 percent of ports report that hazardous materials shipments usually or always must travel over congested routes in urbanized areas (Table 5-2). For routes without practical alternatives, carriers serving the ports must first gain waivers or exemptions from the appropriate state or local regulatory authorities. Gaining waivers, however, does not appear to be a problem. Only 7 percent of the large ports in the AAPA survey indicate that carriers serving their port terminals have experienced some problem obtaining exemptions (Table 5-2).

The survey and site visits provided relatively little information about hazardous materials transportation via pipeline and the potential risks to public safety of increased development around these pipelines. This may indicate lack of a problem; pipelines are inherently safer than above-ground modes (TRB 1988). On the other hand, pipelines in urbanized areas were often placed well before current practices for minimizing risk were developed, and some of these pipelines are quite old. Three major pipelines serving the Boston area, for example, had to be closed because of their age and the risk of rupture. The cost of replacing them was prohibitive; fuel oil is now transported from the port to users in the Boston area by truck. Because the committee had relatively little information about hazardous materials transport from ports via pipeline, the rest of this section focuses on routing issues for surface transport. The committee, however, does believe that this issue should be studied in greater depth and that a determination should be made about the appropriateness of pipeline locations that serve ports, separation from encroaching residential and commercial land uses, and risks associated with aged pipelines. For port and local government officials interested in examining these issues, policies designed to enhance public safety by lim-

AAPA Survey

Issue	All Ports (%) (n = 54)	Conta Ports ((n = 2
Hazardous materials and military traffic passes through congested urban areas		
Usually or always	41	40
Some problems with exemptions for hazardous materials and military explosives	7	12
Freight is lost to competitive ports in states with more permissive weight limits	30	52
Special permits available for overweight container	48	22
State or local agencies usually or always enforce truck weight limits	83	80

legislation has been passed, but responsibilities at the
level are varied and diffused, and the regulations gove
lation are still evolving. However, recent federal legi
soon-to-be-issued regulations implementing those regu
tablish greater conformity for routing and provide
port access.

At the federal level, the U.S. Department of Transp
has authority for hazardous materials transportation
ardous Materials Transportation Uniform Safety Act o
DOT, the Research and Special Programs Administrat
the delegated authority to coordinate hazardous mate
functions for all modes except bulk marine cargo (O
cific requirements are prescribed by DOT/RSPA for th
tation of hazardous materials; they include classifica
shipping papers, package markings, labeling, tra
placarding, and routing.

Compliance with DOT's hazardous material regu
around seaports is enforced by the U.S. Coast Gua
Railroad Administration, the Federal Highway

(FHWA), and RSPA within the modes under their purview most states have adopted DOT's hazardous materials re state agencies enforce many regulations as well.

Several other federal agencies have some jurisdiction aspects of hazardous materials transportation (OTA 198 responsible for designating hazardous materials and wastes, and EPA and the Nuclear Regulatory Commissio some transportation requirements (e.g., manifesting and for hazardous and radioactive materials. The Occupatio and Health Administration sets worker protection regulati

State transportation agencies have a key role because of ational responsibilities over state highways, but the exte authority and the manner in which it is exercised vary fr state (OTA 1986; FHWA 1991, 39). Most state agencies t every facet of hazardous materials regulation, routing, an ment, but some have not been given statutory authorit legislatures. In many states the state police have been gr authority.

Responsibility for hazardous materials at the city or lo quite varied. The local police and fire departments usuall primary responsibility for enforcing routing and for resp emergencies.

Rules and regulations for the routing of hazardous ma have a significant impact on port accessibility. Because onl lines, if not just one, serve most ports, hazardous material move on the only available line. On highways, alternative exist, but their use for hazardous materials may be restricte

DOT regulates the highway routing of hazardous mat ments in Title 49, *Code of Federal Regulations*, Section 3 rule generally requires avoidance where possible of heavily areas, tunnels, and narrow streets.

In the 1990 amendments to the Hazardous Materials T tion Act of 1975 (49 U.S.C. App 1801 et seq.), Congress f

> many states and localities have enacted laws and regulat may vary from Federal laws and regulations pertaining to materials, thereby creating the potential for unreasonable other jurisdictions and confounding shippers and carrier tempt to comply with the multiple and conflicting registrati ting, routing, notification, and other regulatory requireme

and shall be conducted in a safe manner.

Additionally, that legislation directed the Secretary of Transportation to establish regulatory standards that states may use in establishing, maintaining, and enforcing specific highway routes over which hazardous materials may and may not be hauled by motor vehicles. These standards are to include a requirement that provides for access to reasonable routes to terminals (49 U.S.C. App 1804). Regulations establishing these standards are expected to be issued soon.

Trucks Carrying Overweight Containers

In March 1989 FHWA reported that fully *one-third* of a random sample of all marine containers entering and leaving the United States during a 1-year period would potentially exceed federal highway weight limits if transported by typical highway equipment (FHWA 1989). Whether these heavy containers would actually violate federal weight limits, however, depends on a complex set of circumstances, including which type of rig was used to haul the container, whether the routes traveled were federal-aid highways, and whether the states in which the containers were hauled have certain exemptions from federal weight limits under federal law. Nonetheless, that a considerable share of container movements come close to the maximum federal limits, combined with the exponential increase in pavement damage caused by their weight, raises concern about the effects of increased container transportation on the condition of state highways. This, in turn, can become an issue impeding efforts to improve landside access.

The effects of overweight container rigs are felt throughout the transportation chain: trucking firms pass on their increased costs from extra maintenance, equipment damage, fines, and accident liability and litigation; to the extent that they are unable to pass these costs on, service deteriorates and the system suffers. Significantly overweight containers can also directly affect container ships, terminals, and trains by causing similar equipment and safety problems. Again, these problems impinge on landside access issues.

Although it is generally recognized as a problem, the overweight container situation is one in which divided governmental responsi-

laws and enforcement practices differ widely; to date, the federal government has not acted to bring state laws and enforcement practices into greater conformity. Many public and private studies and activities are under way, however, that are intended to address and resolve this complex problem.

Concern about the overweight container issue was raised at almost all the ports visited by the DOT study teams. Of the ports in the AAPA survey, more than half of container ports (52 percent) believe that their ports are losing freight because ports in other states have higher weight limits under their higher (grandfathered) weight limits (Table 5-2). In comparison, only 16 percent of respondents for non-container ports believe that their ports are losing freight to ports in states with more permissive limits (Table 5-2). About half of the container ports indicate that their states have special permit programs for allowing the operation of overweight containers. Most ports (83 percent) report that state or local agencies usually or always enforced weight limits.

Many proposals for solving this problem have been put forth. No single solution is adequate by itself. All are beyond port responsibility and authority. A comprehensive solution acceptable to most parties will probably require some combination of approaches. The principal ideas can be grouped into six categories:

- Shipper education,
- Weight enforcement,
- State cooperation and enforcement,
- Bonded shippers,
- Modified tariffs, and
- Special equipment.

These issues are discussed in greater detail in a recent report of the Transportation Research Board (TRB 1992).

OPPORTUNITIES

Regional Planning

From the mid-1970s to the early 1980s, several regional port plan-

ment needs with environmental protection. One study, and its implementation, for the San Francisco Bay Area (which includes six marine terminals) appears to have been among the most successful (Fay 1985). The plan was developed jointly by the Metropolitan Transportation Commission (MTC) and the Bay Conservation and Development Commission (BCDC) in consultation with the area ports and environmental groups. MTC is a nine-county planning agency for the area; it has state authority to develop regional transportation priorities. BCDC is a state agency responsible for regulating the dredging and filling of the San Francisco Bay Area and the development of the shoreline.[1]

The San Francisco Bay Area Seaport Plan was developed over several years during which technical studies were conducted, port and environmental group interests were considered, and a mechanism was developed for enforcing the plan through BCDC's permitting authority. Although the ports initially resisted the planning process, they ultimately realized that MTC and BCDC had authority to act without their involvement and agreed to participate (Fay 1985).

The Seaport Plan was designed primarily to address environmental concerns about the bay, but it also addresses deep-water channels and ground access. Although the plan has several provisions, two are fundamental: terminal development is to be allowed only where a need can be demonstrated, and terminals should be located at sites considered best for the plan, the land for which is protected for marine uses. For its part, BCDC uses the plan to improve the predictability of requests for permits and to reduce delays in permit applications that arise when duplicative investments are proposed. MTC uses the plan in its regionwide surface transportation planning.

In reviewing the success of the Seaport Plan compared with other efforts, Fay (1985), a planner with MTC, notes that implementation authority—in this case through permitting—is essential and that the agencies developing the plans must be prepared to support the planning process over a long period, first to develop the plan and then to manage revisions. In addition, the competing ports must recognize their common interests and the benefits of cooperating. The benefits for the region include the approval of only those terminal development projects that have regionwide justification, which minimizes the harmful effects to the bay. The benefits for ports include the assurance that approved projects will have expedited state permits and that efforts will be made

The Seaport Plan has not resolved all problems. Competition between Bay Area cities and their ports reemerges from time to time, ports still face competition for land from commercial developers, federal approval and permits for dredging operate outside the plan, and interregional port competition still exists (Dahms 1992). Nonetheless, the plan has had many successes. For example, according to MTC, the Bay Area ports, absent the disruptions caused by the Loma Prieta earthquake of 1989, achieved good highway access, partly because of the priority setting by MTC for major highway projects needed to serve the ports (Dahms 1992). The success of this effort appears to have required state enabling legislation (both for environmental protection and for regional transportation planning in which the regulatory agencies had the authority to make decisions) and a willingness to cooperate. Without the power of BCDC to approve permits and the ability of MTC to coordinate transportation investments, the ports may never have agreed to cooperate (Fay 1985). From the perspective of many in the port industry, the regional planning process has not been as successful as promised. The permitting process is still slow, and federal permits are not governed by the process. Most would agree, however, that there has been value in bringing the many parties with an interest in the bay together into a single forum in which conflicting interests can be negotiated.

Port officials who compete with one another in the same region will have difficulty accepting this approach, but environmental constraints and limited transportation funds already restrict the ability of ports to expand their facilities when other ports in the same region are underused. Regional planning that coordinates environmental and transportation plans represents a way of balancing environmental and transportation goals that has had some success. *The committee recommends that metropolitan planning organizations (MPOs) consider both development and environmental needs in a port region when analyzing port access needs. The ability to exercise these opportunities may require specific state action to enable and empower regional planning organizations to develop and implement regional plans; where required, states should grant such authority.*

Expedited Permitting

The most common lament about working with environmental protec-

procedures exist for reducing the delay, however. For example, COE has a process referred to as "special area management plans" (SAMPs) or regional permits in which estuary or areawide permits are issued for common problems. Each problem does not require a full-blown Section 404 review; instead, it falls under the areawide permit. In some areas the COE permitting process is considerably quicker than that of the state (some states have more stringent environmental standards than those in federal law), but in other states expedited permitting has yet to be used. By extension of the SAMP, the COE could issue an areawide permit for a port's harbor complex that would cover a common set of problems. *Permits for responding to common areawide problems (SAMPS) and regional permits should be relied on more extensively by COE; this concept might even be applied to a common set of problems encountered by all the ports in a single harbor.*

Mitigation Planning

Port development often requires the mitigation of unavoidable damage to the environment. Resource agencies often require that considerably more land be mitigated than is harmed in development, in a ratio occasionally as high as 5 to 1. As a result, identifying and preserving wetlands for mitigation is vital for future development. Wessel and Hershman (1988) recommend that ports include harbor-wide mitigation planning as part of long-range development plans in recognition that mitigation of some kind may well be required in order to obtain permits.

> Public ports have an interest in the greater harbor area, not just specific development sites. . . . A harbor-wide approach to mitigation provides greater opportunities for siting mitigation projects and enhances permit "certainty" for long-range development plans. Ports can conduct or collaborate on necessary research. An improved information base can aid in both impact assessment and establishing trade-off values. Ports can form liaisons with environmental management units and in turn predict their concerns in advance of project review. Port projects that are environmentally sound and successfully compensate for adverse impacts can lead to greater public support for the port authority. (Wessel and Hershman 1988, 283)

Clark (1990) points out that many of the delays in permitting

a part of a Section 404 permit. Instead, mitigation often emerges after a permit has been requested and evolves as a condition of receiving a permit after extensive negotiations between and among the developers, COE, and other involved agencies. By including mitigation planning as part of port development plans, this source of delay in the permitting process could be reduced. Wessel and Hershman note, however, that mitigation planning is not a panacea. The criteria for project review under Section 404 are stringent, and mitigation is allowed only after "all steps to avoid or minimize impacts" have been taken.

Mitigation banking is one possible part of a plan, although the process is still formative and entails many scientific and procedural uncertainties. Mitigation banking might be done on a regional basis, involving all the ports in a single harbor. The ports in San Francisco Bay, for example, are considering such an approach.

In addition to coordinating more with their MPOs, ports in the same region should cooperate more with each other to help reduce any harm done to the environment by port projects. *The committee recommends port cooperation for mitigation planning on a regional or harborwide basis, including planning for mitigation banking—the restoration or enhancement of a wetland before development to help obtain and fulfill permit requirements.*

The ISTEA makes clear that protecting and enhancing wetlands are eligible expenses for federal transportation funding [Sections 1006(d)(13) and 1007(b)(10)]. For those highways classified as part of the national primary system that serves interstate commerce and for those more local roads that are part of a state or regional system, "participation in wetlands mitigation efforts related to projects funded under this title, which may include participation in wetlands mitigation banks, contributions to statewide and regional efforts to conserve, restore, enhance and create wetlands, and development of statewide and regional conservation and mitigation plans . . . may take place concurrent with or in advance of project construction" [Section 1006(d)(13)].

Given the importance of and popular support for environmental protection, ports and local governments find themselves more accountable for protecting the environment when improving landside access. The federal government has provided additional assistance in meeting environmental goals. The ISTEA makes explicit allowance

financing wetlands. *Port officials should be aware of and apply for using such funds to compensate for the environmental effects of improving port access facilities.*

Other Environmental Opportunities

Reduced vehicular emissions could also be attained by setting more stringent standards for the engines that power trucks and trains. The efficacy and costs and benefits of such proposals, however, were beyond the scope of this study committee. For the problem of buried hazardous wastes, many new procedures are being developed to detoxify or contain such materials. This is a complex and constantly changing area, however, and the committee had no special expertise. The National Cooperative Highway Research Program, a research program managed by the Transportation Research Board, has issued a guidebook to help transportation officials confront this problem (NCHRP, 1988) and has a second study under way to review emerging procedures and identify exemplary state programs for dealing with buried hazardous materials. The report of this second study is expected to be completed in 1992.

NOTE

1. Gilliam (1980) provides a brief and favorable history of BCDC and its role in mediating environmental protection of the San Francisco Bay with demand for development.

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ABBREVIATIONS

DOT	U.S. Department of Transportation
FHWA	Federal Highway Administration
NCHRP	National Cooperative Highway Research Program
OTA	Office of Technology Assessment
TRB	Transportation Research Board

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6

Defense Deployment

Seaports have an important role in national defense; thus, the existence of landside impediments to ports raises concerns about military readiness in addition to those of transportation efficiency. Many of the resolutions to these impediments are the same as those addressed elsewhere in this report, but some requirements for military readiness are unique.

The enormous logistical support required for deploying U.S. troops during the Desert Shield/Storm buildup of 1990–1991 illustrates the dependence of the modern military on the civil infrastructure of the United States. Seaports played a major role. More than 4 million tons of cargo were shipped through U.S. ports alone to provide material to troops deployed in the Persian Gulf (considerable amounts of equipment were shipped from Europe and other locations as well). By most accounts few bottlenecks occurred at domestic ports, but not only did the buildup occur during a period in which other business was slack, it unfolded over 7 months: in a crisis requiring a faster or larger mobilization, more commercial cargo shipments

more heavily on intermodal transportation and the private sector to move military cargo for resupply and sustainment (*Containerisation International* 1991).

BACKGROUND

The U.S. Department of Transportation (DOT) considers the capacity of the nation's seaports to be adequate to meet projected requirements for national defense, although it recognizes that a large increase in cargo movements would strain the system (DOT 1990 16-3). In the event of a national emergency, some disruption in commercial cargo is to be expected. For example, for the Desert Shield/Storm unit moves, the Military Sealift Command used virtually all the world's ships capable of being loaded by driving the vehicles aboard, referred to as roll on–roll off (RoRo) ships. The demand for these ships and the large number of vehicles to be loaded on them caused extensive marshalling of land vehicles at the affected ports. Although the problems encountered were not serious enough to warrant federal intervention, the Maritime Administration, acting through existing federal port controller contracts, has standby authority to assume control and management of port assets to ensure that military cargo receives sufficient priority.

A review of the experience of the ports involved in Desert Shield/Storm supports DOT's view that there is adequate port capacity. About 18 domestic ports were involved in support of the Desert Shield/Storm buildup. Of the 14 civil ports, the 12 that responded to the American Association of Port Authorities (AAPA) survey moved 84 percent of the total cargo and include two ports with by far the largest share of total cargo. In the initial unit moves, vehicles and their contents were the primary items shipped. Almost all of the containerized goods shipped through these ports were sustainment cargoes, that is, prepackaged foods, spare parts, and other dry goods.

According to the AAPA port survey, the buildup for Desert Shield/Storm went fairly smoothly. Two ports indicate that the shipments strained normal commercial operations, and one other port indicates that military cargo disrupted normal operations at the other terminals. Ten of the 12 respondents, however, indicate that military cargo

would not encounter any landside access impediments at their ports. The ports involved in Desert Shield/Storm report landside access problems in roughly the same proportion as other ports in the AAPA survey, except that there is less indication of a problem with many rail-highway crossings and no reports that the condition of rail lines impedes access (Table 6-1).

Conversations with staff of the Military Traffic Management Command (MTMC) indicate that they were not aware of any serious impediments to port landside access during the deployment. Some logistical problems did occur, such as the arrival ahead of schedule of large deliveries by truck and rail that could not be accommodated immediately, but in general port throughput was considered adequate. The ports handling RoRo traffic did experience landside congestion, but this was caused primarily by a shortage of ships and vessels.

TABLE 6-1 Ports Involved in Desert Shield/Storm in AAPA Survey

	All Ports ($n = 54$)		Ports Involved in Desert Storm[a] ($n = 12$)	
Survey Question	No.	Percent	No.	Percent
Truck routes congested				
Usually or always	27	50	7	58
Sometimes	22	24	5	42
Numerous at-grade rail-highway crossings	25	46	4	33
Condition of rail lines impedes access	4	8	0	0
Hours of terminal operation primarily restricted by local work rules	8	15	2	16
Hazardous and military traffic must use corridors through congested urban areas	22	41	6	50
Military cargoes would encounter some access impediments	8	14	2	16

[a] The ports are Beaumont, Charleston, Gulfport, Hampton Roads, Houston Jacksonville, Long Beach, New York and New Jersey, Oakland, Savannah, Ta

domestic shipments (about 40 percent of the tonnage) was handled by two ports (Jacksonville, Florida, and Houston, Texas) that do not have access problems characteristic of other ports. For example, truck routes serving these two ports are not usually congested. Although rail lines serving the ports share the rights-of-way with public streets, they do not encounter frequent at-grade rail crossings, nor does the condition of rail lines impede access. The rest of the U.S. tonnage was scattered among a fairly large number of other military and civilian ports and did not account for a significant share of the tonnage at these ports.

Many other reasons help explain why the deployment went fairly smoothly. Four months elapsed before hostilities began. The surface transportation system in the United States has considerable capacity, as do the ports themselves. As large as the deployment of cargo for Desert Shield/Storm was through the U.S. ports, the nation's 180 ports move 200 times more cargo each year (Sherman 1991). The preexistence of port planning groups convened to organize and facilitate military uses of ports also helped resolve issues quickly that could have caused more delay (Sherman 1991). A substantial amount of "forward-based" cargo shipped from non-U.S. ports relieved the pressure on U.S. ports. Saudi Arabia provided extensive amounts of sustainment cargo to U.S. troops. Finally, DOT and the Department of Defense (DOD) succeeded in ensuring an adequate network of routes for military deployment.

DOT and DOD have planned extensively for military use of the U.S. surface transportation system. They have jointly identified defense highway needs, which consist of the 59,800-mi Strategic Highway Corridor Network (STRAHNET) and some 6,000 mi of connector routes extending between STRAHNET and important defense installations. STRAHNET consists of the Interstates and 16,300 mi of additional major routes. It provides defense access, continuity, and emergency capability for the movement of personnel, materiel, and equipment. DOD, the Federal Highway Administration, and the state DOTs have worked together to identify and maintain records on this system and to give these routes priority in addressing the specific needs of the military—for example, in ensuring adequate bridge clearances. The Intermodal Surface Transportation Efficiency Act of 1991 incorporates the STRAHNET and connector routes to the STRAHNET into a new classification of

primary highways (the National Highway System, or NHS). Routes on the NHS will be eligible for the highest level of federal aid (80 percent) except for Interstate highways, which continue to have a federal share of 90 percent [Section 1006(a)(D)].

A subset of rail lines important for national defense and security has also been identified, which includes the 38,800-mi strategic rail network, or STRACNET, and 5,000 mi of connector lines to military installations. The Federal Railroad Administration and MTMC jointly identify corridors that are important to the military, and these agencies revise and update these designations every 3 years.

FUTURE ISSUES

Future mobilizations of U.S. armed forces are likely to affect ports in different ways. Issues of concern in future mobilizations regard proposals to containerize more sustainment and resupply cargo and to ship more ammunition and other supplies in the vehicles deployed during the unit moves. Before Desert Shield/Storm, DOT indicated that "currently, there is excess port capacity to meet defense transportation needs except in one area, the movement of containerized conventional ammunition" (DOT 1990, 16-10). The DOT report notes that the options for addressing this problem included building more container-handling capacity at military ports and relying more heavily on commercial ports. General Hansford Johnson, the commander in chief of the U.S. Transportation Command, which was in charge of the deployment for Desert Shield/Storm, has indicated that a larger share of resupply break-bulk cargo, including ammunition, will need to be containerized in future deployments (*Containerisation International* 1991). The military has only one port—Sunny Point, located near Wilmington, North Carolina—that is dedicated to handling ammunition loaded in containers,[1] and the equipment at this port is not state of the art. Other ports that might be used for handling containerized ammunition are likely to be military facilities, but landside impediments might be encountered because many rail lines and highways serving military ports cross urbanized areas. Half of the ports involved in Desert Shield/Storm report that military traffic must use corridors through congested urban areas (Table 6-1). Because moving explosives along congested corridors is a sensitive issue, those facilities capable of handling such cargo would be limited in

Other pending shifts in defense policy could also affect
Most notably, DOD planners are discussing the need to r
ployments from the 120 days required for Desert Shield/St
days, and looming cuts in the number of troops could resu
stantial reductions in forward-based personnel and equipm
ing a future mobilization, more people and materiel will nee
more quickly.

With the military now planning to place greater relian
containerized transportation of sustainment cargo by pri
than it has in the past, military, DOT, and state DOT plann
move beyond identifying the highways and rail corridors im
the military and assess the adequacy of the intermodal cc
between strategic highways, rail lines, and the ports likely t
on for military sealifts.

OPPORTUNITIES

Coordinated Planning

Despite the apparently smooth functioning of the ports d
buildup for Desert Storm, continued planning and analys
landside access will be needed. Local development and infr
decisions take place independent of considerations abou
defense or security needs. In a military scenario different fr
Shield/Storm, other ports might be needed for deploymen
which landside impediments exist. For these reasons, mi
civilian planners need to have access to and use of analy
that address the potential throughput of ports, the capacity
corridors at key ports, and the demands that would be
them under various defense scenarios.

If proposals to rely more heavily on containers for movi
nition proceed, particularly important would be identifying
ate corridors and port terminals. For ports deemed su
handling containerized ammunition, corridors that curren
traverse densely populated areas should be identified and

To ensure that state and local governments consider the corridors between major highways and ports that are important for national security and defense, *the federal government should require planners at DOD and DOT to continue periodically identifying corridors that may be needed for future deployments of troops or military hardware and ammunition.*

DOD Funding

Federal law mandates that surface transportation projects, including highways of military significance, be paid for by federal transportation funds of the DOT. Defense public highway needs are provided for through the Highway Trust Fund. Accordingly, DOD funds are not used to support STRAHNET or connector routes. DOD planners may identify projects of military significance, but DOD funds are not used because DOT funds are designated for this purpose. In contrast, ome water projects of military significance do receive DOD support. In some surface projects of military and national significance, it may e appropriate for Congress to consider allowing DOD funding to supplement federal highway trust funds. For example, some state or local governments may place less priority on funding the state or local share of a project that the military believes it needs but that does not ave specific benefits for the local community; if the military pays for he local share, the project is more likely to move forward.

The committee recommends that Congress consider allowing DOD to provide the local share of funding for transportation projects that are of military significance but that are not a priority for local governments.

If DOD could help fund roadway projects, however, members of Congress in pursuit of federal support for their local highway projects might ask that their local routes be designated as militarily significant. Thus, if this provision were incorporated into law, specific criteria to help minimize such practice should be incorporated as well.

NOTE

1. As used in this chapter, the term "containers" includes other container-like

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ABBREVIATION

DOT U.S. Department of Transportation

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7

Institutional Relationships

For some ports the weakest link in the logistics chain is at their back doors, at which congested roads or inadequate rail linkages to marine terminals, and sometimes both, result in delays and increased transportation costs. Direct influence over these issues, however, is often out of the reach of port officials; the responsibility for road and highway improvement projects resides with a city, county, or state government. In the private sector, decisions about most rail line investments, with the exception of a few municipally owned belt lines, are made by privately owned railroads, and decisions about ports-of-call and many terminal investments are made by private shipping lines. Reviewed in the first section of this chapter are some of the relationships among units of government that can inhibit responses to the landside transportation needs of ports. Port access problems could be significantly aided by several shifts in policy and organizational responsibilities that will occur because of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. These policy shifts, and the changes in jurisdic-

Port Institutional Status

The unique institutional arrangement of most ports allows them to operate with a great deal of autonomy in the business-oriented setting in which they operate, but it may impair their coordination with other units of government. Most ports are government-owned enterprises, which gives them a relatively high degree of autonomy from other units of government and allows them to operate more or less like a business (Olson 1988). The public and enterprise dimensions of ports are based on creation and ownership by government and include a statutory provision of powers. The enterprise function has four features:

> [E]xpectations of market efficiencies in operations, commercially defined performance goals, reliance on user fees for operating expenses and capital markets for construction funds rather than general government appropriations, and the absence of partisan intervention in its operations. (Olson 1988, 310)

In practice each port is somewhat different and incorporates these features in varied degrees. Most public ports (a few are private) operate independent of other units of government and for the most part focus on the basic goal of moving freight efficiently. In their environment of "splendid isolation" ports have had discretion to perform this mission with

> economy, efficiency, and effectiveness. . . . Strong executive leadership and governing board cooperation helped to continue seaport separatism from the mainstream of local government politics, economic crises and tax revolts. (Shaw 1990, 1)

As landside constraints build, however, ports find themselves operating in a new arena: national and state surface transportation policies and programs are carried out by a different set of participants than those with whom ports are accustomed to working (Shaw 1990, 2).

Port institutional affiliations with other units of government are quite varied, however, which accounts for the different communication and coordination problems of ports from state to state. Port

iation (New Haven, Connecticut) to being a department of a city government (Los Angeles and Long Beach), to operating autonomously in a separate district (Seattle and Tacoma, Washington), to being part of state government (Maryland, Hawaii, Maine, North Carolina), to being a state enterprise (Massachusetts Port Authority, Virginia Port Authority), to being an agency of more than one state (Port Authority of New York and New Jersey, Delaware River Port Authority) (Olson 1988). These different institutional arrangements yield different opportunities and constraints, but, as will be discussed, some state governments recognize the economic importance of their seaports and are beginning to act to ensure that landside congestion problems do not cause their ports to become less competitive than those in other states.

As the point at which land, water, and modes of transportation intersect, ports have long had a complex set of interactions with governmental authorities responsible for water and land transportation and natural resource conservation, and among private providers of transportation services (Shaw 1984; Shaw 1985). Port relationships with the federal government have recently undergone fundamental changes due to shifts in federal policy that are outlined in the next section. These changes have, in some cases, shifted some responsibilities to the state level and allowed private firms to make decisions independent of the ports that nevertheless directly affect the ports' future. Ports find themselves dealing increasingly with problems of surface transportation programs and policies "for which they have little expertise, authority, responsibility, or power" (Shaw 1990). Shifts in federal transportation policy are among the most important recent changes affecting ports. Most notably, in December 1991 Congress passed and the President signed a 6–year reauthorization of the federal surface transportation programs. As indicated in specific areas addressed in earlier chapters, the policy statements and specific provisions of the ISTEA will benefit port access in many ways. In terms of the topics covered in this chapter, it will also shift some planning and decision-making authority in metropolitan areas from states to metropolitan planning organizations (MPOs). Because MPOs tend to be sensitive to the kinds of local pressures from neighborhood groups, land developers, and environmental groups outlined in previous chapters, this shift in authority raises concern about how

must become much more involved in local transportation planning and policy making to ensure that their needs are addressed.

Federal Role

Unlike other industrialized nations involved in seagoing trade, the United States does not have a specific, integrated federal policy on ports (Hershman and Kory 1988). The federal government has long been involved directly and indirectly in port development, however, and policies and practices for waterway development, economic regulation of transportation, environmental protection, and surface transportation influence ports in myriad and complex ways. These policies are also changing, or evolving over time, and they are having decisive effects on many ports.

Waterway Development

Since the beginning of the nation, the federal government, acting through the U.S. Army Corps of Engineers (COE), has subsidized waterway transportation by building channels, dredging harbors and channels, and building harbors with landfill. Some background on the development and changing nature of this policy provides a useful contrast with federal surface transportation policy.

President Monroe wanted COE to represent the national interest through centralized planning, but Congress rejected this proposal. It opted instead for COE to consider waterway projects on a case-by-case basis, with authorization for projects made directly by Congress (Marine Board 1985). During the nearly 150 years of this practice, individual projects were identified, selected, authorized, and funded in a complex and lengthy process, which gave individual members of Congress a great deal of direct influence (Marine Board 1985, 21). While the nation grew, many coastal ports developed, some of which were in direct competition with each other; but the piecemeal, ad hoc approach to waterway development at the national level avoided any federal role in specifying ports of national significance. Ultimately, however, the approach was criticized because congressional logrolling resulted in specific favors being given to some ports, helping them at the expense of their competitors, and because this approach allowed

significance—that is, it led to pork-barrel politics (Ferejohn 1974).

Partly because of budgetary pressures on discretionary spending and partly because of efforts to impose executive branch perspectives on inefficiencies in public and private investment, the Carter and Reagan administrations intervened in this long-standing federal-COE-local port process. President Carter vetoed bills containing western water projects and coastal dredging projects because he was concerned about their excessive expense. During the Reagan administration, ports were required to begin sharing the cost of harbor and channel dredging. The requirement of local contributions to dredging favors ports with greater natural geographic advantages and economic activity: either they tend to need no dredging or they can generate enough revenue to invest in the local share. Ports that require substantial dredging or have less economic activity were disadvantaged by this shift in federal policy.

Economic Regulation of Transportation

Other shifts in federal policy have directly affected ports and further altered the competitive balance among them. The deregulation of trucking, rail, and shipping lines has fundamentally altered the regulatory oversight that the Interstate Commerce Commission (ICC) exercised over trucking and rail companies as well as the protection the Federal Maritime Commission (FMC) exercised to help ensure that ports received cargo sent to or from their natural hinterlands.

For-hire transportation companies, with minimal regulatory oversight, now determine how and where they operate and how much they charge for their services. In such an environment, intermodal companies have focused their activities on a smaller number of ports in order to achieve economies of scale and scope and thereby offer attractive rates to shippers. In addition, the substantial deregulation of surface freight modes marked an end to such regulatory policies as rate equalization, whereby the ICC had regulated land transport freight rates to equalize the cost of moving freight within the geographic ranges of ports. Without such requirements, carriers have been able to put together rate and service packages that are market-driven rather than being artificially constrained to use specific ports.

From 1920 to 1978, FMC had assured ports that they had a right

Kory 1988, 105). In a series of rulings based on the latitude given to shippers in the Shipping Act of 1984, FMC has allowed carriers to offer land-bridge services and has rejected port arguments about their rights to cargo from their natural hinterlands. Shippers and transportation providers seeking efficiencies and competitive advantages are no longer constrained to use specific ports, and ports with fewer natural advantages have become less competitive.[1] Thus, though there is no specific federal port policy, the effect of policies such as these has been to facilitate competition among the existing ports, and marketplace conditions have tended to favor steamship lines that concentrate their calls at fewer ports.

The competition among ports fostered by these rulings can be viewed as a de facto federal policy, one quite consistent with federal policies in other economic spheres. Encouraging competition has long been believed to result in service-oriented ports that try to control costs and innovate in order to gain advantage over their rivals.

The competition among ports is intensified, however, by the economic development efforts of some states and cities to invest in port development on a speculative basis, which results in an oversupply of capacity. Oversupply leads to below-cost pricing of some port facilities and to criticism by environmentalists of investments that are "wasteful, unnecessarily destroying wetlands and expending funds on redundant facilities" (Kagan 1990). Despite leading to excessive investment in some instances, the committee believes that competition among ports has helped ensure that there is adequate capacity for the efficient movement of interstate cargo. In any event, given the long history of the federal government in avoiding centralized planning in the allocation of resources, port competition will occur and bring with it the attendant advantages and disadvantages.

Environmental Protection

Federal policies for environmental protection were described in Chapter 5. Worth noting in this discussion is that as the federal policies on waterways development and economic regulation illustrate a reduced federal role on ports, environmental policies illustrate increased federal constraints on port activities (Hershman and Bittner 1988)

The absence of a federal port policy has left the development and promotion of individual ports to the states and localities. Many states are active promoters and supporters of their ports; nevertheless, not all ports are accustomed to working with state and local transportation agencies.

Financial Support

State policies that affect ports are many and varied, as are the relationships of individual ports with their states. Some ports are completely independent of state government; others are quite integrated. Ports in states such as Georgia, Indiana, Maryland, New Hampshire, North Carolina, Rhode Island, South Carolina, and Virginia operate as parts of statewide port authorities. In most other states, ports operate as either individual port authorities or bistate authorities. Some states—Connecticut, Louisiana, Maryland, and Virginia, for example—also have general transportation trust funds that are used for investments in all modes. Many states provide funds to their ports through their state transportation agency; they include Hawaii, Illinois, Louisiana, Maine, New York, and Wisconsin.

Regardless of how ports are related to their states, 26 of the 41 states on navigable waterways helped fund landside port facilities and cargo terminals during the 1977–1986 period, and 20 helped fund construction of access roadways and rail spurs (AASHTO 1987). Thus, it appears that many states are involved in promoting their ports and resolving landside access problems.

The state funds invested in landside facilities during this time totaled $1.4 billion. About half of the funds were provided by the sale of general obligation bonds, which are backed by the state treasury but usually repaid by the ports. About a quarter of the funds were raised through general taxes and paid for out the state's general fund. The sale of revenue bonds funded about 15 percent of these investments (although subsequent changes in federal tax policy greatly reduced this option). These bonds are often backed by the state but paid for out of port revenues. Maryland was the only state during this period to pay for a substantial amount of port development out of the state's transportation trust fund ($117 million). Toll revenues, user charges, pri-

Many ports experience deficiencies in highways and roads serving them but have neither the funds nor the authority to make the needed improvements. In the past, and until the specific changes required by the ISTEA take effect, one of two problems has arisen when a port proposes that state transportation department funds be spent to make the improvements: either the state transportation department, when comparing these proposals with other demands on its budget, has not ranked them high enough to warrant the investment or the improvements are found to be ineligible for state or federal highway funds and that has been given as the reason not to carry them out. With the passage of the ISTEA, planning and budgeting for transportation capital needs in urbanized areas will be determined to a much larger extent by MPOs.

Among the ports visited by the U.S. Department of Transportation (DOT) study team, the Port of Charleston appeared to have the least success in obtaining state transportation funds. Officials there stated that the state legislature's policy of distributing highway funds evenly across the state made that body unsympathetic to any kind of costly highway project in an urban area. Other ports experience some difficulties working with their states. For example, during the site visit to a port on the Mississippi River, a state transportation official stated that the port is not a constituent of the state transportation agency because it does not contribute to the Highway Trust Fund. (Of course, the trucks serving the terminals do pay state road user taxes.) At the other extreme, New Orleans port officials have achieved a high degree of cooperation with state officials and have succeeded in getting the improvements they want. Some port officials in Texas and in California also indicated close coordination with their state transportation departments.

Other ports visited by the DOT study teams indicated mixed success in obtaining funds for access improvements. Toledo port officials have worked with local authorities to develop a master transportation plan and have secured agreement that a new highway river crossing, costing from $100 million to $300 million, should receive the highest priority. But state support for the project is not ensured. Port officials speak of turning to toll revenues to make up for any lack of state support.

Although the ports of Tacoma and Seattle operate as autonomous entities, the Washington State Department of Transportation

(WSDOT) recognizes the importance of these ports to the state's economy and has addressed port needs in statewide transportation apital planning. In 1985 and 1991 WSDOT participated with the Washington Public Ports Association in a statewide analysis of the ports and transportation systems necessary to support freight movements in the future. The 1985 report concluded that the ports have ood access to major state and Interstate highways, although these outes are congested during periods of peak demand (TAMS 1985). The 1991 study addressed all modes of the total transportation system, public and private. Although Washington State port access is found to be good generally, access constraints are identified (Belyea et al. 1992). Improvement projects are under way for these access constraints, and other improvements to the functioning of the system are ecommended.

The ports of Los Angeles and Long Beach are units of local government, which implies that they have some additional influence over ocal street improvements, but local streets still present landside constraints because some streets belong to other municipalities. Trucks must compete with local traffic, and the at-grade rail lines that intersect local streets often result in long delays for motorists. The San Pedro Bay ports, however, have presented a compelling case of the need to resolve their problems. As a result, the state transportation commission (with staff assistance provided by the ports) issued a report recognizing their needs and suggested that some local streets can and should be considered eligible for state funding (California Transportation Commission 1990). In addition, the area governments have banded together with the ports to form a joint powers authority to build a dedicated rail-highway corridor (the Alameda Corridor) connecting the ports to Interstate highways and intermoda terminals (Hicks 1991). The progress made on this project has been due largely to a considerable degree of cooperation between the ports and the local and state governments. The main issues still to be resolved include how to fund the $1.5 billion to $2.2 billion project how much to compensate the Southern Pacific Railroad, which owns the right-of-way for the rail line in the Alameda Corridor; and how to gain the cooperation of neighborhoods and communities to allow the Alameda Corridor to be made eligible for state and federal funds Recent reports indicate that whereas the state has supported the Al ameda project in concept, state funds have not been equally forth

Some states have taken an active role in responding to port landside access needs. About 40 percent of the ports in the American Association of Port Authorities (AAPA) survey indicate that their state transportation agencies usually or always coordinate activities such as road construction with them, but 20 percent of the respondents say their states rarely or never do so (Table 7-1). Some state DOTs have unified transportation trust funds that collect all user fees into a single pool; these funds give them considerable flexibility in funding specific transportation projects, especially in states in which funding decisions are reached administratively rather than legislatively. Florida also has begun to establish a separate fund to address access problems.

The Virginia Port Authority has jurisdiction over all five terminals in the Hampton Roads area, and in 1986 the Virginia General Assem-

TABLE 7-1 Institutional Issues Identified in AAPA Survey

	All Ports ($n = 54$)		Container Ports ($n = 25$)		All Other ($n = 29$)	
Issue	No.	Percent	No.	Percent	No.	Percent
State DOT coordinates with port						
Usually or always	22	41	10	40	12	41
Sometimes	13	24	9	36	4	14
Rarely or never	10	20	6	24	4	17
MPOs or regional agencies serve coordinating function for ports						
Yes	26	48	16	64	10	34
No	17	31	5	25	12	41
Yes, but not effective	6	11	2	8	4	14
Port staff person coordinates port access needs with state and local agency	31	57	16	64	15	52

annual allocations for each mode. The highway access needs of Hampton Roads terminals appear to have been considered in several highway improvements currently under way by the Virginia DOT. For the long run (2010 and beyond) the Virginia Port Authority believes that additional improvements will be needed to expand the capacity of the Interstates serving the ports. These needs, though expensive, are reflected in the state DOT's long-range plans. The multiple demands for funding and the revenue difficulties of many states, however, suggest that funding for many of these improvements will be difficult to obtain.

Some of the difficulties that ports face in working with other transportation agencies of local and state government on the land side may relate to the completely different set of arrangements that have existed historically on the water side. Throughout the history of the United States, the executive branch has had little influence over port development, and despite the more recent interjections of federal authority to control the cost of dredging projects, the ports have traditionally worked directly with their congressional delegations to promote projects in their interest. On the land side, the process is an administrative one with a great deal of shared influence and control at different levels of government.

Federal Highway Aid. To grasp the broader context of approving and funding highway projects, one must look first at the traditional institutional arrangements that existed (up until recent changes adopted in the ISTEA) for financing and making decisions about highway investments in the United States. Although the federal government has taken a leadership role in surface transportation policy, the programs and the funds are administered by the states. For this reason the federal role is treated in this discussion.

The federal-aid highway program is financed through fuel taxes and other highway user fees, which generate revenues for the Highway Trust Fund. The Federal Highway Administration (FHWA), a DOT agency, administers the federal-aid highway program. FHWA, however, does not make direct investments in highways; money from the Highway Trust Fund is apportioned among the states. There are different matching ratios of federal and state funds for each of the federal-aid systems that existed before passage of the ISTEA: the Interstate, the primary, the secondary, and the urban. The systems

have been designated by FHWA, working with the states, and are quite specific. Any section of road in the country is on one or the other of the four systems, or it is on none of them (e.g., a local street). With the exception of rehabilitating or rebuilding bridges, a project must have been on one of these systems if it is to be eligible for federal funds. The ISTEA changes the federal-aid categories to just three: the National Highway System, which is to be 155,000 mi of primary interstate highways (including the 44,000-mi Interstate system); the Surface Transportation Program, which includes all nonprimary highways except local streets and rural collector roads; and the Bridge Program. Under the Bridge Program, a state selects the bridge projects it chooses to finance with federal aid, using a funding formula established for the program.

The amount to be apportioned annually among the states for each of these systems is fixed in the highway authorization bills that Congress enacts, typically every 2 or 4 years. The apportionment formulas for the various systems are also set by Congress; they are not often changed. Federal money may not be used to pay for the total cost of a project. The states must contribute a share of the cost. Under the old programs, the state shares were 10 percent on the Interstate, 25 percent on the other systems, and 20 percent for bridges. Under the ISTEA, the state shares are 20 percent for all routes except the Interstates, which remain at 10 percent.

Federal-aid funding categories establish the boundaries within which a state operates. The amount of funds that a state receives each year for each system is fixed by statute. Eligibility, or the criteria for the projects for which the funds may be used, is fixed by the system designations set forth by FHWA. By design, it is an arrangement in which the federal government has virtually no part in project selection. Under the old programs, the state highway department, typically lodged in a state DOT in which it is by far the dominant agency, has made the decisions about highway investment. As mentioned, the ISTEA gives MPOs in urbanized areas a much larger role than they had before.

The use of federal money does impose some requirements on the states. Any project that uses federal funds must meet federal standards and follow federal procedures. There are engineering standards and environmental standards. For projects in urban areas, there are planning requirements designed to ensure that the highway department's decisions are coordinated with a metropolitan planning pro-

cess. Not only must these various requirements and standards be met, but federal-aid projects must receive FHWA approval. The exceptions would be "demonstration projects," which are authorized by Congress directly.

FHWA's concern, however, is with procedural, environmental, and design standards and with the engineering integrity of a project. It is the state highway departments that develop the projects from conception to construction. In general, FHWA does not use its approval authority to interfere with the states' highway investment priorities. In the normal course of administering the highway program, it has not been the FHWA's role to tell a state highway department to give special preference to projects that would be useful to ports or to any other class of projects.

For anyone coming new to the workings of the federal highway program, it is important to understand that the state's role as the key decision maker has been the fundamental political agreement that underlies the program. It is not a feature that evolved in a manner incidental to some larger goal; it has always been there. If anything, given the provisions of the ISTEA, the discretion and flexibility accorded the states in determining highway project eligibility will increase, although they will share this with MPOs in urbanized areas.

The ISTEA gives MPOs considerably more authority in urbanized areas with populations of 200,000 or more. In these larger cities, MPOs will develop short- and long-range capital plans, and the MPOs will select projects in consultation with their state DOTs. In urbanized areas with populations of 50,000 to 200,000, the state DOT will select projects in consultation with the MPO. For cities with populations of fewer than 50,000, the state role in project selection continues more or less as before. In the paragraphs that follow, the leadership role that states have in the federal-aid highway program is described in terms of the arrangements that existed until the passage of the ISTEA in 1991. It should be understood that after that time the states' role in larger urbanized areas has been reduced by the ISTEA; MPOs have been given the primary role in project selection.

One more aspect of the current institutional arrangements should be mentioned. A number of states, particularly the larger ones, distribute some of the federal-aid money and occasionally some of their own money to local governments. In these states, the highway department will be directly responsible for projects on the state road system

but will leave project selection involving other roads to local authorities, usually at the county level in a nonurbanized area. Thus, the pattern in which the higher level of government hands on highway funds and responsibility to the lower levels recurs in state-to-county and state-to-city transfers. For the balance of this section a state transportation agency, the state legislature, or a highway commission is the decision maker, but in some states an agency of local government may make the decisions.

Operating in such a setting, a state highway department pursues its course, reflecting the political arena in which it must work and its own views of what the best highway projects are. State highway departments are largely staffed and run by civil engineers. They do not usually carry out the kind of formal economic analysis that, for example, the COE performs for navigation, flood control, or other civil works projects. They will, however, be concerned with reducing congestion, improving safety, and preserving the system in good physical condition, and they will try to meet all these objectives in designing projects. Inevitably, the design process will have both analytical and political components.

As noted, a port authority that tries to inject itself into this process and seek approval for a highway project may find itself rebuffed, generally for one of two reasons. Either the project has not been on a federal-aid system or the state decision-making body did not rank the project high enough to include it in its program. These reasons need not be mutually exclusive.

Stated another way, ineligibility for federal aid is not always a sufficient reason to reject a project. Whether it is depends on the amount of highway money available to the state from its own resources to match the federal money apportioned to it. The federal money a state receives each year imposes a minimum level of spending; it is "use-it-or-lose-it" money. If a state does not come forward within a specified time with projects and matching money to exhaust its apportionment, the unclaimed part returns to FHWA. Because the state will thereby lose federal funds, this does not happen often.

If a state's highway money is enough to provide only its share, often called the match, then it is restricted to projects, federally approved, and ineligibility is enough to make a project unacceptable. However, if the state's resources exceed the required match, then the state has the flexibility to invest in projects without federal aid, and ineligibility is not an insuperable obstacle. Many, but by no means all,

states can spend more for highway projects than is required to match trust fund apportionments; they are "overmatching." When a state is overmatching, ineligibility is an excuse, not a reason, for rejecting a project desired by a port.

Obstacles to Funding. It is useful to set aside the eligibility issue and consider the two other reasons for which a state's failure to embrace a port's proposal may be appropriate. The first is the one in which the state's rejection of the port improvement project is a correct economic decision. There might be enough projects, with net economic benefit greater than the port's project, to exhaust the state's investment budget. If true, the decision to exclude the port project is in the best interests of the state as a whole.

The second case is the one in which the investment sought by the port does, indeed, have the economic merit to justify its inclusion in the state's program. Here there is a real problem. The possible causes for the state's rejection may fall into one or another, or some combination, of the following categories:

- *Politics.* The port authority's influence with the state highway decision-makers may be so slight in comparison with other interests that seek projects that a port improvement project never receives serious consideration. The state's funds are exhausted in meeting the demands of more powerful claimants. Alternatively, a project may find its way onto a long-range capital plan but never be given sufficient priority to move forward.
- *Procedures.* Port officials may be unfamiliar with the operations of the state highway development process and thus fail to make their case at the right time or in the right way to be considered in the state's routine project selection procedures. The port's project then appears as extraneous to the selection process and does not receive thorough consideration.
- *Communication.* In some way, port officials may fail to convey sufficient information to highway decision makers on the benefits they expect to flow from the project in question. Senior port officials are professionals who are often oriented to promotion and marketing; a major part of their task is to sell their ports' services in intense competition with other ports. Highway decision makers are typically legislators or professionals, or both, who represent the community by serving on boards of highway commissions; their project priorities

reflect those of their constituents. If the port is unable to convey its project priorities and their economic benefits to these decision makers, there is little chance that these projects will be advanced. Highway departments, on the other hand, are staffed and managed almost entirely by civil engineers, men and women trained in the methodical evaluation of projects using objective data for criteria: traffic counts, accident rates, delays due to congestion, and so forth. Part of the communications problem arises from the divergent points of view and backgrounds of the participants seeking to influence the highway planning process.

- *Misjudgment.* The highway officials may have all the relevant information, consider it fully, and conclude that a project desired by the port is not worthy of funding, even though objective outside analysts would reach a different conclusion.

These kinds of problems raise some concern about the ability of ports to obtain funding for projects that may be of national importance—because they serve interstate and international commerce or because they are of military value—but that may not be given priority when local and state funding decisions are made.

Changes in federal surface transportation policy in the ISTEA place even greater significance on local decision making. Even before the ISTEA, MPOs provided some coordination functions; 48 percent of the respondents to the AAPA survey indicate that coordination existed, but they give no indication of the quality of that coordination (Table 7-1). However, 31 percent indicate that the MPOs are not involved, and 11 percent indicate that their MPOs are involved but ineffective. The future decisions that MPOs will make about the eligibility of port access routes for state and federal aid will be important. Neighborhood groups concerned about noise, environmental groups opposed to transportation projects, and land developers interested more in commercial than port development of waterfront land have the potential to have greater influence on projects that could benefit ports than they have had in the past. In this context,

> increasing America's valuation of efficient intermodal transportation seems all the more difficult because of a political system in which nationally important infrastructure development decisions are made locally, influenced by legal and political institutions that focus attention primarily on local interests and preferences. (Kagan 1990, 177)

Many ports are trying to communicate their needs to local groups and to influence local decisions. More than half of the ports (57 percent) indicate that they have a staff person assigned to coordinate port access needs with state and local transportation authorities (Table 7-1). The survey does not indicate, however, whether these staff are high enough in status to influence the outcome of local decisions or whether the groups with which they coordinate are actually decision-making bodies. As Kagan (1990) concludes from examining the difficulties in port development in the decentralized and adversarial governmental mode in the United States, new governmental methods are needed to help reconcile the conflicting and competing interests of various groups. At the time of this writing, the ISTEA goal of making existing government institutions more intermodal has been stated but not yet realized. Federal, state, and local transportation agencies are only just beginning to grapple with intermodal transportation.

PRIVATE INSTITUTIONS

During the mid-1800s, when the railroads were the only mechanized form of interstate land transportation, most ports were actually owned or controlled by individual railroads (Hershman and Bittner 1988, 39). Most bulk terminals are still owned by individual railroads, but most general cargo terminals have come under the control of public authorities.

The specific impediments to rail access were discussed in Chapter 3; in summary, they have the effect of increasing the time and cost of moving goods to and from the docks of a particular port. For shipping lines, the quality of highways, port terminals, and rail access all play a part in decisions about which ports will receive calls.

In dealing with railroads and steamship lines, ports must respond to a different set of issues than when working with government transportation agencies (private-sector issues in terminal operating efficiency are also discussed in Chapter 8). It is not a matter of convincing a firm that a particular action or investment is in society's interest; it is a matter of determining whether the investment will be profitable in comparison with other investments. At first glance, there ought to be a high degree of congruity

between the port's interests and those of the railroads and shipping lines: the port wants more traffic, and, presumably, so do the private firms. If an action to bring more traffic were to involve significant costs for the railroad, then one would expect a divergence of interests. Alternatively, ports may find themselves competing with each other to attract rail service from the same railroad; in this case, it is not just the infrastructure constraints that influence the investment decision of the railroad, although they surely play a part.

In some instances, rail access improvements can be made by the railroad or a terminal can be built by a shipping line, and the issue is one of simple economics. The firm will make the investment if it is profitable in comparison with other opportunities for investment. Often, however, the resolution of access problems is also outside the control of the private sector, although private firms may be able to contribute to the cost of improvements. Thus—to return to the discussion of government transportation agencies—port officials may find themselves seeking the cooperation and funding of local and state authorities to solve bottlenecks to landside access, recognizing that the railroad or shipping line may shift its investments elsewhere if these problems cannot be solved.

OPPORTUNITIES

The opportunities for reducing the institutional barriers between ports and surface transportation providers would be facilitated by the options that follow.

Federal Role

The ability of ports to influence state and local transportation authorities and to overcome a predominance of local perspectives would be enhanced by a careful and continuing assessment of port access problems and possible solutions to these problems. The ISTEA makes a major step in this direction. The bill states that it is national transportation policy for the national intermodal system to "provide improved access to ports and airports, the Nation's link to world commerce." The bill also requires MPOs and states to include port access needs in

their transportation planning. Besides setting forth requirements for more comprehensive planning, the bill also allows states and MPOs to spend a larger proportion of federal aid on planning; such spending was based on a formula allocation in previous legislation.

As the ISTEA shifts the locus of decision making toward states and MPOs, it remains important for the federal government to communicate the national interest in routes that are critical for the movement of interstate and international commerce. *The committee recommends that the Office of Intermodalism ensure that studies are conducted periodically on the port access routes important to interstate and international commerce and national defense and that this information is conveyed to state and local officials responsible for funding decisions and to all parties concerned about the improvement of these routes.*

Increased federal support for local and state assessment of port access needs could help develop a better data base for identifying projects and for improving local transportation planning to facilitate cargo movements. A 1992 Transportation Research Board report found that the major gap in DOT data collection is data on the origin, destination, and mode of freight flows (TRB 1992). It also noted that data collection is a low-profile activity in the federal government, one without many champions. *The committee recommends that the Office of Intermodalism advocate the importance of intermodal freight transportation and that it strongly encourage the new Bureau of Transportation Statistics in DOT to make its highest priority the redressing of serious shortcomings in intermodal freight flow data.*

The eligibility criteria for federal aid in the ISTEA as implied in Sections 1006(d) and 1007(b) are quite broad; the intent of the legislation is to give greater flexibility to local and state officials in meeting intermodal transportation needs. Thus, it appears that dedicated freight corridors such as the Alameda Corridor project, as well as highway-railroad grade separation projects that are required for such corridors, will be eligible for funding if the roads are classified by the MPOs or states as part of either the National Highway System or the Surface Transportation System. In this regard port officials should be working directly with their MPOs to ensure that their access routes are considered for classification under these systems. A proposed classification of all highways is to be presented to the Congress by December 1993; until then ports can recommend that routes important to them be designated as part of one of these systems.

The bill also greatly eases restrictions on toll facilities on federal-aid routes and the potential uses of toll revenues. Not only are prohibitions on tolls lifted (with the exception of the Interstates), but the revenues from such facilities are eligible for any activity also eligible under the provisions of the ISTEA once commitments to debt service and adequate maintenance have been met [Section 1012(a)(3)].

The emphasis on these kinds of administrative procedures is consistent with the committee's view that the federal role should be one of communicating to state and local officials, and to the public at large, the national priority of certain projects (regarding interstate and international commerce and security) and one of giving local and port officials incentives and additional flexibility for making these investments. The intent is not to identify ports that are of a greater national priority than others. To t' e contrary, in the committee's judgment the decentralized and competitive port system that has evolved in the absence of centralized port planning has benefited interstate commerce. With surface transportation policies shifting farther toward local and state influence, however, it is important to identify and communicate the federal interest and to give localities options that will serve their interests as well.

Relying on administrative procedures, as opposed to political agreements, helps reduce concerns about the pork-barrel approach that has caused a long-standing criticism of the selection and funding of some waterside projects. If projects were identified and assessed according to specific criteria, projects of only local significance would have a lesser chance of being funded.

One of the basic engineering criteria that FHWA uses in determining project eligibility for federal aid is the number of vehicles expected to use a facility. Many port access routes generate substantial truck traffic but may not carry the large number of passenger vehicles characteristic of federal-aid routes. *Rather than simply rely on traffic counts to determine the eligibility of a route for federal aid, FHWA should develop criteria based on the importance of routes for interstate commerce and national competitiveness and a favorable benefit-cost ratio.*

Adequate funding for port access improvements—either landside or operational improvements that would reduce the demands placed on the landside system—is a major issue. In theory individual ports can impose user charges to help fund specific projects, but in practice the competition among ports is such that port managements are un-

willing to impose such fees for fear that they will lose cargo to their competitors. The competition among ports is so keen that many ports accept lower land leases and wharfage fees than they wish to earn in order to outbid rival ports (Dowd 1988, 219).

The success and growth of other modes—highways and aviation, in particular—is partly due to the establishment of a federal trust fund in which the users of the system are taxed directly and the revenues reinvested in the system. Shippers using the ports are already taxed by the federal government, for customs and for dredging fees, but these funds are not all placed in a trust fund. Customs revenues become part of the general fund, and dredging fees are placed in the Harbor Maintenance Fund, which the COE uses for dredging projects.

The concept of a federally imposed tax is appealing because a single charge could be imposed on all users of ports, which would offset the inability or unwillingness of individual ports to impose their own landside access fee. In principle, a trust fund would operate as follows: a small tax placed on the users of the ports generates revenue for port landside access improvements, and these funds are used to match other federal and state sources in investments in facilities, including investments to compensate for effects on the environment, that reduce landside bottlenecks. A federal tax solves this problem, but it raises other difficult issues.

The toughest question appears to be which form of taxation to use. A flat tax on the tonnage or volume of freight would most directly impose a charge on the user of the transportation system. However, many cargoes are of low cost per ton, and some, such as lumber, grain, and coal, are important export products whose demand on world markets is sensitive to small changes in price. Taxing these commodities is likely to be difficult politically. Taxing the value of freight, or diverting customs fees from the general fund to a trust fund, would shift the tax to commodities that are less price-sensitive, but it would also shift the bulk of the taxation to container ports, because most high-value goods are shipped in containers. A similar problem emerged when the harbor maintenance fees were proposed; the battle over this question was divisive and required several years of often bitter negotiation (Hershman and Kory 1988, 107). By taxing the value of freight, the container ports would, in effect, provide revenues for a fund that could be used to solve the access problems of their competitors. This could result in inefficient cross subsidies if the political price for obtaining a trust fund required an equal distribu-

tion of revenues to ports around the country. The resolution to this problem depends on finding a fee system that would raise sufficient revenues to address landside access needs and that would return the revenues to the ports that generated them.

Another problem without a simple solution is that of the diversion of freight to competitive ports in Canada. The harbor maintenance tax, for example, already causes some high-value freight in the Northeast to move through Canadian ports rather than through U.S. ports (Aylward 1991; DiBenedetto 1992). Because of trade agreements with Canada, it is not practical to impose a border-crossing fee to equalize the harbor maintenance tax. The ports of the Northwest are also very close to competitive ports in Canada.

Although this proposal for a federal landside access fee involves some difficulties, it deserves further study and consideration. It may be one way of overcoming the persistent problem of inadequate local funds to match federal transportation funds. *The Office of Intermodalism should ensure that a study is carried out on the feasibility of this proposal.*

State Role

Ports not situated in urbanized areas might have greater influence with landside transportation decisions at the state level if they had formal mechanisms for working with state transportation agencies. Such mechanisms appear to be needed at both the technical and policy levels. Several states have developed different ways of considering and giving priority to port access needs. These mechanisms could be studied to determine those that are most effective. State multimodal trust funds, such as those in Louisiana, Maryland, and Virginia, give ports greater influence at the state level by providing a dedicated source of funds. *The committee recommends that states consider establishing multimodal transportation trust funds in order to provide a funding source for port access needs.*

States could also require regional transportation and environmental planning agencies to coordinate with ports. Although individual ports may not have benefited as much as they had wanted, as a group, the San Francisco Bay Area ports have benefited from the efforts of the Bay Conservation Development Commission and the Metropolitan Transportation Commission (see Chapter 5); this example suggests a model approach.

Regional and Local Roles

At the local or regional level, transportation planners will be required by the ISTEA to give more detailed consideration to freight transportation needs than they have in the past. Besides requiring that specific attention be paid to port access needs, the legislation requires the assessment of "methods to enhance the efficient movement of freight" [Section 1024(f)(7) and (11)]. The intent is clearly one of fostering an intermodal approach. Aside from including "intermodal" in the title of the bill, the ISTEA requires the MPOs to develop long-range plans that identify needs and capital resources for "transportation facilities (including but not limited to major roadways, transit, and multimodal and intermodal facilities) that should function as an integrated metropolitan transportation system, giving emphasis to those facilities that serve important national and regional transportation functions" [Section 1024(g)(2)(A)].

State and local governments as well as port officials can take several steps to facilitate landside access to maritime industries. *As required by the ISTEA, freight transportation needs should be given more detailed consideration when routes are designated as eligible for federal and state assistance and in assigning priorities for funding.* This recommendation should be applied immediately in the identification of routes eligible for the National Highway System, which is to include the Interstates and other major primary highways. This system, to be funded at the highest level, is to be defined by FHWA with the assistance of the states and MPOs and presented to Congress by December 1993. *States and MPOs should also include freight transportation facilities in the development of their intermodal transportation facility plans.*

Port Role

Some ports may need for their top port officials to invest more time and energy in local, state, and federal surface transportation planning and policy making. Although many port officials already actively market the importance of their ports to their local and regional economies, such efforts will continue to be needed to influence highway transportation investments, especially in light of the greater prominence given to MPOs in local decision making by the ISTEA and the

requirements for the new federal-aid system designations to be made within 2 years after passage of the act.

Because of the ISTEA's new emphasis on MPOs for planning and decision making, combined with statewide intermodal planning requirements, port officials should become much more involved in the planning activities of their MPOs and state DOTs. The act indicates that MPOs should include elected officials, appropriate state officials, and officials of local transportation agencies. This indicates that port officials can be directly involved in their MPOs, as they already are in some states and metropolitan areas. For example, to ensure the consideration of freight transportation needs, Washington State recently required MPOs in the state to include a port official on their boards. *Port officials should seize these opportunities to ensure that (a) their access routes are considered for inclusion in the designation of the National Highway System and (b) their MPOs conform to the intermodal freight transportation planning requirements of the ISTEA, which includes providing for port access routes. As state and local officials deal with the intermodal requirements of the ISTEA, port officials should take the initiative to make sure intermodal freight transportation needs are included.*

Ports can also take a leadership role in showing MPO and state transportation planners how alternative investments in port facilities can reduce the demands on already-congested highways. Greater state or local funds invested in grade separation projects or, on a larger scale, a dedicated transportation corridor may improve rail access and reduce the demand for highway transportation or shift truck operations from residential streets onto separate facilities. Alternatively, investments to improve barge shipments may allow commodities that had been transported partly by land to move by water. Such investments will become more and more important as the ability of local and state governments to expand highway capacity diminishes in the future, and they are more likely to be supported by federal aid given the increased flexibility in funding provided by the ISTEA.

Local elected officials should also be reminded of the importance of ports to local jobs and businesses, of the importance of double-stack rail service to modern container ports, and of the mobility of private investments in the deregulated era. *Port officials should be actively educating local elected officials, commercial, neighborhood, and environmental groups about the transportation needs of ports; the roles that ports play in moving*

international cargo and providing for national defense; and the economic benefits that ports give to their cities and regions.

NOTE

1. The Shipping Act of 1984 addressed some of the anticompetitive issues that arise from abuses in carrier and port conferences that set joint rates and tariffs. Such conferences are still permitted, but more flexibility was given in the act. Shippers and carriers can negotiate rates somewhat independent of these conferences, and the FMC can overrule anticompetitive arrangements. Somewhat contrary to the general policy of fostering competition among service providers in the maritime industry, the ports were extended antitrust immunity under the Shipping Act of 1984 to discuss and set joint fees. Ports on the East Coast have not cooperated in this fashion, but they have recently proposed to, and the California ports have exercised this option—to the consternation of some shipping lines and shippers. Considerable controversy surrounds this provision in the shipping act (*Traffic World* 1991a, 21).

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AASHTO	American Association of State Highway and Transportation Officials
TAMS	TAMS Consultants, Inc.
TRB	Transportation Research Board

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8

Intermodal Terminal Efficiency

Modern intermodal marine terminals are the points of transfer of cargoes from sea to land and land to sea, but the transfer is less than optimal. The transfer of cargo between ports and inland transport is "one of the weakest, least efficient, and most costly links in the intermodal transportation chain" (Hayuth 1987, 36).

It is not difficult to see why. A large container ship, using two or three gantry cranes, can offload five hundred or more 40-foot containers in half a day. Several ships can be in port simultaneously. Storage space on or near the docks is extremely expensive. Container trains and trucks are costly to operate; they don't want to wait. Customers demand on-time deliveries. Yet each container has to be cleared through customs and directed to the right outbound truck, which in turn must plunge, in direct competition with scores of other trucks onto the crowded roadways that link the urban waterfront to railheads and the on-ramps of inter-city highways.

Meanwhile, trucks are streaming into the port with new cargo for the off-loading ship. At the terminal gates, each inbound and outbound trucks's driver must present or pick up documents transferring custody. The identity, destination, and condition of each container and chassis must be checked. Inbound trucks must be directed to the appropriate

> space in the container yard to pick up or drop off a container. Like a highway accident during rush hour, the slightest problem, misunderstanding, or impropriety in the paperwork clogs the terminal gate. Gate delays increase during lunch hours or when ship arrivals bunch up. Frequently, lines of trucks pile up at the inbound or outbound terminal gates, polluting the air, fraying tempers, and adding to transportation costs. (Kagan 1990, 131)

The recent gains in intermodal productivity probably exacerbated the landside access problem because marine terminals can off-load and deliver far more cargo than access routes can accept. One of the major future challenges will be to control the flow of containers so that bottlenecks can be avoided.

Eugene Pentimonti, vice-president of American President Lines, noted at a 1991 Transportation Research Board Strategic Planning Workshop for Marine Transportation that the remarkable productivity gains in intermodal transportation over the past 30 years have resulted from technology improvements on the "hard side"—that is, from containerization; larger container ships; larger, more sophisticated cranes; and double-stack trains. Pentimonti predicted that further productivity gains will depend on innovations on the "soft side," by which he meant greater reliance on information technologies to improve the flow of containers through terminals and improved labor-management relations. Changes in both areas will be needed to manage the landside access problem.

INFORMATION TECHNOLOGY

Some of the landside bottleneck problem may be reduced by more efficient internal operations at port terminals. Information, communication, and integrated data systems are fundamental to such improvements and will be needed for the marine terminals to continue to improve their productivity (Marine Board 1986).

Current Practices

New information technologies are already being applied to port terminal operations in many ways. Bar-coded containers are being used for inventory and for reading and entering shipping documents elec-

tronically. Using hand-held optical scanners transmits information about container identification and location with far greater accuracy and efficiency than does repeatedly entering the information manually. These systems have some problems operating in the often wet and cold terminal environment, but they are being refined. Microwave scanners and radio-frequency microcircuit systems have been developed to overcome some of the limitations of these technologies, and some products are being widely marketed. The advantages of radio-frequency systems have led to their being widely adopted at ports around the world (Friedman 1986a; Friedman 1986b).

With greater accuracy about container location and identification and with computerized information bases, terminal managers can develop and apply management information systems to improve the flow of containers through the terminal with reduced handling (Chadwin et al. 1990). One impediment to the wider use of automated information collection and transmittal is the lack of standardization across modes and countries, but one vendor is capturing such a large share of the market for radio frequency transponders that its sheer scale of operation may result in greater standardization—much as IBM set standards in personal computing.

Management of improved information flows can also be achieved through harmonized, interactive electronic data interchange (EDI) systems. As shippers, ports, freight forwarders, and transportation companies have computerized their record systems, the major impediment to transmitting more paperwork electronically has been the incompatibility of the many systems (*American Shipper* 1988). Many industry committees, however, are working on standardization to acilitate communication between computers.

So much change is occurring in EDI that the current status is difficult to characterize. A wide variety of systems are in use; each system has differing capabilities and degrees of sophistication. A certain mount of standardization in EDI has occurred because of the formats required for automated customs clearance: as customs documents have become standardized and transmitted electronically, the xtensive paperwork involved has become less of a bottleneck. About three-quarters of container ports in the American Association of Port Authorities (AAPA) survey report that automated customs systems are in use at their terminals, and about half (44 percent) indicate that these systems usually or always reduce access time to or in the port (Table 8-1).

TABLE 8-1 Issues Regarding Terminal Operating Efficiency Raised in AAPA Survey

Issue	All Ports ($n = 54$)		Container Ports ($n = 25$)		All Other ($n = 29$)	
	No.	Percent	No.	Percent	No.	Percent
Automated customs clearance	24	44	19	76	5	17
Automated customs clearance usually or always reduces delay	8	15	8	44	n/a	n/a
Labor contract the major impediment to increased operating hours						
Yes	8	15	7	28	1	3
Yes and no	8	15	5	20	3	10
Expansion of terminal operating hours would improve efficiency	13	24	13	52	0	0
Port has on- or off-dock transfer facilities	34	63	22	88	12	41
Off-dock more efficient than on-dock	12	22	6	24	6	21
Rail lines adjacent to or within 1 mi of marine terminals	49	91	24	93	25	86
Rail-highway intermodal terminal adjacent to marine terminal	6	11	5	20	1	3
within 25 mi	19	35	10	40	9	31

In applying information technologies to traffic and cargo management, U.S. ports in general lag behind the most sophisticated ports in Europe and Asia. These ports are already investing in the software, computer links, fiber optic networks, and mobile radio terminals that

vill allow the terminal managers to better control inventories and ıanage the flow of containers across the terminal (*Port Development ıternational* 1991). Some observers believe the large international orts that dominate their national markets have an advantage over ıe decentralized ports in the United States. These major interna- onal ports are believed to have the long-term stability and revenues o invest in the research and development that is necessary for the ransfer to computerized operations (Kagan 1990, 181). On the other and, large vertically integrated companies, such as Sea-Land, are ıaking similar investments in the terminals they own (*Port Develop- ıent International* 1991).

uture Applications

me of the landside bottlenecks in port terminals result from the urge of containers: hundreds may be off-loaded from a container essel or double-stack train in just a few hours. At present, terminal perators at domestic ports tend to treat the incoming containers qually because they do not always know which contain time- ensitive cargoes and which do not. With more advance information, ıe handling and placing of the containers could be arranged to mini- ıize inefficiencies. The most time-sensitive containers could be put vhere they would get priority treatment. Computer simulation ıodels are being developed and marketed to assist in this next gener- tion of logistics planning (Chadwin et al. 1990, 74). The Japanese teamship line Nippon Yusen Kaisha already performs computer sim- lations of its terminals before container arrivals so it can plan for the ıost efficient flow through the terminal. Steamship lines often have ıuch of the information that would be needed by the terminal opera- ors and surface transportation providers to engage in more advanced lanning, and as production transportation logistics become more ophisticated, even more of this information will be available.

Terminal throughput will be aided by the continued evolution to- vard automated container-identification systems. It will not be many ıore years before each container will have a standardized tag or ransponder that can be read as the container is being moved. Con- ainers entering the terminal on the land side will electronically trans- ıit all the necessary paperwork for passing through the gate and for learing customs. The containers being off-loaded from the ship will

be staged such that the crane operator knows which container to pick up next and where it needs to go.

As terminal use becomes more efficient through the use of information and sophisticated logistics models, some of the peak demand and resulting congestion as containers are drayed out onto the highway can be alleviated. Indeed, the capacity of the roadway system to handle outgoing containers would be one element of the simulation models used to inform logistics decisions.

During the next 20 to 30 years, roads and highways will become increasingly "smart"; that is, they will have electronics added to the pavement or roadside that will allow traffic managers to continuously monitor, and perhaps control, traffic volumes (TRB 1992). Thus, the capacity of the highway system to receive the flow of container traffic will one day be known in real time, and even this information will become part of commercial transportation logistics.

The benefits of improved flow through the terminal depend on better planning, and better planning depends on better information, but ports face practical impediments to information sharing. Steamship lines, for example, traditionally prefer to operate on a proprietary basis.

The institution of overarching coordinating groups among the port users can facilitate information flows among competing interests. This has been done at several ports. One example is the Virginia Port Advisory Committee at Hampton Roads. This committee, which includes all maritime-related interests, is convened to ensure that lines of communication are open and that all issues of common concern are being addressed. Another such effort was the introduction of the Freight Service Improvement Conference, which was created by the Port Authority of New York and New Jersey.

Logistics alliances also suggest ways that competitors can agree to share information for the mutual benefit of multiple parties (Bowersox 1990). In these alliances, manufacturers, shippers, and transportation companies (sometimes even traditional competitors) align services for mutual benefit. For example, a double-stack operation by American President Companies (APC) between Ford plants in Michigan and Mexico depends on the coordination of information by the manufacturer, four railroads, and Mexican customs. APC assembles and coordinates all the information necessary to pick up and deliver parts between the two plants and to coordinate these movements over four rail lines and on a just-in-time basis. This

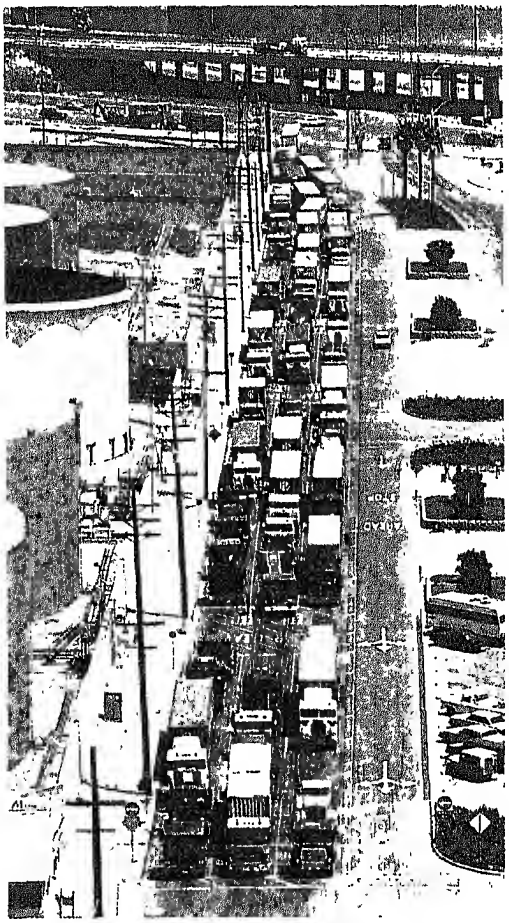
example indicates that information can be provided in ways to protect proprietary interests while still permitting planning for complex, time-sensitive logistics.

In the future the production of some goods will be planned such that they move out of the factory to a container, out of the port of exit, across the ocean, through a domestic port, and to the point of distribution. Imagine garments made at a factory in Asia: they are affixed with price tags, hung on rolling hangers, and placed in a container to arrive at the store in the Midwest several days later, where they will be rolled out of the container and onto the showroom floor just in time for a big sale. The transportation system would no longer respond to production output as it is pushed out of the factory door; just-in-time delivery is a "pull" system, in which customer demand at the outlet generates requirements for goods to be transported. The transportation logistics for production planning such as this have not yet been developed, but for the marine terminals to operate with the efficiencies implied by these futuristic logistics, several changes will be needed: standardized information technologies, techniques for sharing proprietary information, and modified work rules at some port terminals.

INCREASED TERMINAL EFFICIENCY

Operating Hours

Because of the large scale of container ships and double-stack trains, hundreds of containers are off-loaded onto the marine terminal. All of these containers need to move in a short period of time, which creates a surge in demand that often causes congestion at terminal gates and on terminal access roads. Such problems are exacerbated by terminals at which local work rules result in a fixed workday of 8 hr with a 1-hr lunch break. For example, truckers at the Port of New York and New Jersey reported to the U.S. Department of Transportation (DOT) site visit team that trucks at the terminals are already lined up 100 deep when the longshoremen start work at 8:00 a.m. In New Orleans truckers reported that the current congestion problems could be reduced if the local unions



A queue of trucks backs up at a port entrance awaiting processing. Note that the queue is beginning to spill onto the intersecting route.

would lengthen the working day from 7:00 a.m. to 7:00 p.m. (The effect of neighborhood opposition to operation of trucks and trains during early morning and nighttime hours was discussed in Chapter 4.) In some places the morning opening times create safety hazards both in the immediate vicinity and some distance away: when truckers park at an Interstate rest stop waiting for the terminal gates to open, the line backs up onto the shoulder of the highway. In contrast, some port terminal gates are open around the clock when required. When draymen can work throughout the night to clear the containers, a surge of truck movements is not forced onto already-crowded highways during the working day.

The operation of gates for longer hours increases the productivity of port assets and allows truck and train movements to occur during the off-peak travel hours. Almost all container port terminals will operate around the clock when a large container ship arrives. Because of the expense associated with lengthy dwell times, the ship operator is usually willing to pay the extra labor costs. On the land side, however, in order to open the gate to allow truckers to pick up

or drop containers, which may require only a clerk and one or two workers in the terminal, some local union work rules require that an entire crew be paid overtime for a full shift.

For half of the container ports, expanded operating hours would reduce the delays encountered on landside routes (Table 8-1). One of the major impediments to operating longer hours has been the unwillingness of some seaport labor union locals to change work rules to reduce the cost of opening the terminal gates during early morning or early evening hours. This is reported to be a problem for almost half of the container ports. For 28 percent, restrictive work rules are believed to be the major constraint on operating longer hours. For another 20 percent, the unwillingness of union locals to permit the opening of gates without requiring overtime pay for an entire crew appears to contribute to the port's inability to operate longer hours.

The resistance of labor unions to extended work hours is understandable. Labor has experienced a radical reduction in the demand for workers because of the increased mechanization and productivity of intermodal container movements. After nearly a century of effort to gain the benefits of work rules, benefits, and wages, longshoremen found the number of jobs declining and the competition between ports increasing as general freight cargo shifted to containers (Chadwin et al. 1990). In 1970, for example,

> 30,000 longshoremen at the Port of New York/New Jersey worked 33 million manhours to move about 25 million "assessment tons." By 1986 only 7,400 dockworkers were on the rolls and they worked a little more than 11 million manhours to move the same amount of cargo (Chadwin et al. 1990).

Although the longshoremen unions have acceded to many of the technological changes in the industry, some work rules continue to reduce the ability of terminal operators to improve throughput. For example, one proposal would simply have a clerk operate the gates during off-hours so that truckers could drop containers. But at many ports, the union locals insist that opening the gate means an entire work crew must be paid overtime, even if the whole crew is not needed.

The master agreements of the longshoremen unions permit locals to negotiate some work rules separately with their managements. The competition among ports has apparently created flexibility at some

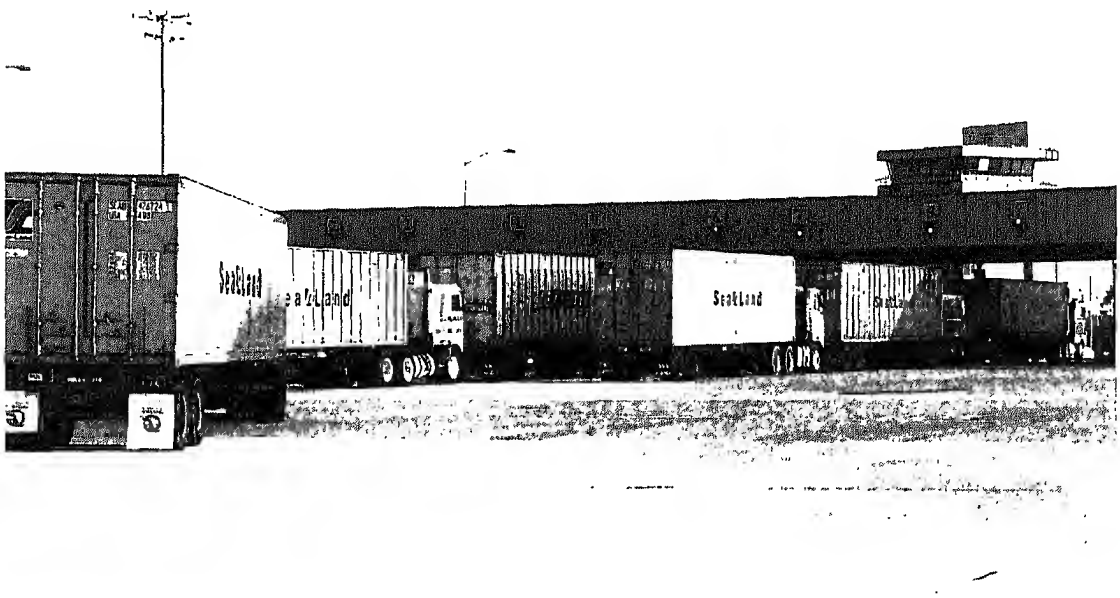
locals in renegotiating less restrictive limits on port operating hours. Hampton Roads' success in the competition with Baltimore is credited by some to the more harmonious labor-management relations at Hampton Roads and to the Virginia unions' recognition that changes in work rules to win freight would create jobs and opportunities. A similar argument can be made about the success of Tacoma in competing with Seattle.

Other Operational Changes

The increased automation in container identification described earlier can also be applied to other aspects of terminal operations that would reduce bottlenecks at the gate. With fewer delays imposed on truck operations, fewer trucks would be required to make the same number of deliveries.

Equipment Interchange

A major source of delay at the gate occurs in the preparation of the equipment interchange report. Each container and chassis entering or



Delays in processing containers at terminal gates could be reduced with electronic information transfers.

leaving a berth must be inspected by a longshore clerk. The clerk and the driver inspect the equipment and make note of any dents or damage. The driver then signs the report. If there are exceptions to the report between the time the equipment leaves and the time it is returned, the owner of the equipment bills the trucking firm that handled the equipment.

This process could be streamlined. Inspections could take place away from the gate. The trucking companies could post bonds for damages. Drivers working for these companies could be given electronic identification cards. When the loaded truck passes the gate, the driver identification and equipment identification could be transmitted electronically along with the container information already being transmitted.

Changes would be required for this improvement. Work rules would have to be negotiated with longshoremen unions. Shipping lines and trucking firms would have to negotiate new arrangements for handling equipment damage.

Mobile Gates

Another approach to reducing queues at the gate would be to have multiple, mobile gates. With "wired terminals" and mobile radio-frequency transmitters, there is no reason to operate with a few gates through which all incoming and outgoing trucks must pass. If gates were operated at the berths as dictated by demand, the queues at each gate would be smaller, and those that occurred would be on terminal routes, not on public access routes.

Advance Scheduling

Another cause of terminal congestion is the frequent rush of last-minute cargo that causes a peak demand on truck equipment and terminal access routes. Freight consolidation yards often have a large volume of cargo arriving a day before the ship is scheduled to depart; this cargo must be loaded into containers and drayed to the berth for loading. If shippers were required to have cargo at the consolidation yard another day or two before the ship was to sail, less equipment would be needed to move the cargo at the last minute and peak demands would be reduced. Shipping lines have been reluctant to impose such schedules for fear of losing cargo (most accept cargo up

until 4 hr before the deadline), but there may be ways to protect the lines by having the port or terminal operator set the schedule and impose it uniformly.

More Productive Trucks

The peak demands caused when containers must be drayed to railheads could be alleviated if trucks could transport more than one container at a time. Trucks that could pull two containers would reduce the number of power units on the road and thereby reduce congestion and air pollution. Only 20-ft containers can be transported in twin-chassis configurations under current length limits, and these units may be restricted by federal and state weight limits. Twin 40-ft units, comparable with turnpike doubles, if operated to standards comparable to those of turnpike doubles, would be permitted only on routes of the highest design standards and therefore would not be permitted on roads accessing marine terminals. The Intermodal Surface Transportation Efficiency Act of 1991 specifically prohibits the use of longer combination vehicles (LCVs) in states that did not already allow their use on or before June 1, 1991 [Section 1022(b)]. Hence, for now wider use of LCVs to move containers is fairly restricted. If ever allowed, trucks pulling two containers are likely to be limited to dedicated truck corridors and required to operate with more stringent safety standards.

TERMINAL DESIGNS

Many port authorities, particularly the largest ones, have striven to improve port productivity by improving the design of intermodal terminals. Because the geographic and marketing advantages of each port differ, there is no single type of design that predominates. Ports seem to favor terminals designed for stacking containers as opposed to chassis-based transport in equal numbers (Marine Board 1986). There are also divergent views about whether on-dock rail is to be preferred to off-dock rail (Ashar 1990; McKenzie et al. 1989).

Because of the intense competition for freight among ports, however, the ports have been investing in improved terminal designs. Most of the container ports in the AAPA survey (88 percent) report that they have either on- or off-dock transfer facilities (Table 8-1).[1]

About a quarter of the container port respondents believe off-dock designs are more efficient than on-dock. Almost all port respondents (91 percent) report that rail lines are either adjacent to or within a mile of marine terminals. Only 11 percent, however, have rail-highway intermodal terminals next to the marine terminal. Such facilities are reported to be within 25 mi of the marine terminals at 46 percent of the ports. (On-terminal rail access issues were addressed in Chapter 3.)

As available land around ports becomes more expensive and less available, terminal operators may increasingly opt for designs that require stacking rather than having each container on a chassis. A general rule of thumb is that stacked operations require about half as much land as chassis-based systems, but currently the chassis are more mobile and can be moved without having to move other containers; therefore they are more responsive to customer demand for rapid throughput. Improvements in EDI and logistics planning may eventually allow stacked systems to operate with greater speed. In addition, because of the environmental restrictions on use of waterfront land, and the economic cost of such land, stacked designs may one day become more cost-effective.

Continued efforts are needed to keep abreast of innovations and best practices worldwide. Ports in the United States are less productive than the world's most efficient ports for a complex set of logistical, institutional, and legal reasons (Marine Board 1986). Some innovations developed in other nations may not be applicable here for these same reasons. Nonetheless, continued survey of best practices and study of their potential application in U.S. ports are needed.

OPPORTUNITIES

There are many ways to improve internal operations of ports to reduce the demand on landside transportation.

Information Technology and Transfer

It appears that much more efficiency can be gained through improved technology and information sharing. User forums can provide a low-tech approach to improve logistics. There are also a variety of ways in

which steamship companies, drayage firms, and double-stack rail operators can share data to enhance terminal efficiency. Everything from inventory control of containers to advance planning of terminal operations could be improved through more extensive applications of technology, computers, and information systems (Chadwin et al. 1990, 57–77; Marine Board 1986; TRB 1986).

In its role as the coordinator of intermodal research, the Office of Intermodalism should ensure that federal research is conducted on topics related to efficient freight flow to and through port complexes. For example, research on improving and harmonizing information systems and technology could help overcome some of the bottlenecks in information transfer at ports, which, in turn, could improve the flow of vehicles and freight. To ensure that U.S. ports remain competitive, a continuous effort is needed to keep abreast of worldwide innovations in cargo handling and to make that information available to ports and terminal operators. The office should work with ports, metropolitan planning organizations, and states in defining a research agenda that will help them address the issues they face. *The federal government should serve as a catalyst to bring together the various parties involved in the use of technologies such as information systems in order to define joint needs, to promote standardization, and to encourage research on and dissemination of innovations in cargo handling and intermodal freight transportation.*

The U.S. government could also place more emphasis on automating the paperwork that continues to impede efficient throughput at marine terminals. The Customs Service has automated its routine paperwork, but other agencies—the Food and Drug Administration; the Bureau of Alcohol, Tobacco, and Firearms; and the various inspection services of the Department of Agriculture—are just beginning to do so. Almost all clearances are based on routine document reviews only, so increased standardization and automation of documents could substantially reduce delays at terminal gates.

Operational Changes

At many ports it may be possible to increase the hours of terminal operation. Over the long term, the competition among ports for cargo, coupled with the ever-increasing mechanization of the longshoreman's task, is likely to continue to put pressure on restrictive

work rules. But given the monopoly positions of the longshoremen unions and the adversarial, zero-sum-game character of some labor-management relations, longshoremen unions are not likely to agree to significant changes in operating practices without getting something in return (Kagan 1990, 168).

Many improvements in terminal operating procedures could increase terminal efficiency and reduce peak-period congestion. Equipment interchange reports could be streamlined. Driver and equipment reporting at terminal gates could be automated. More gates could be used and could be designed to move to the berths to reduce the number of "choke points" on the terminal. Ship-loading deadlines could be moved up to reduce the last-minute movement of cargo from freight consolidation stations to berths, and more productive truck units could be allowed in specific circumstances.

Applying information-based technologies can also assist in terminal efficiency (Table 8-2). Eighty percent of the container ports in the AAPA survey indicate that traffic management would reduce access problems. Fifty percent indicate that cargo tracking to schedule truck arrivals would improve highway access, and 60 percent believe that computerized rail control techniques would improve rail access. Although many respondents think these approaches would help, only about one-third of the container ports believe that these management techniques would reduce the demand for more costly infrastructure improvements.

Terminal operators and users of port facilities can also take several steps to help reduce the bottlenecks at terminal gates and the peak

TABLE 8-2 Technological Solutions To Improve Highway or Rail Access Identified in AAPA Survey

	All Ports ($n = 54$)		Container Ports ($n = 25$)		All Other ($n = 29$)	
Solution	No.	Percent	No.	Percent	No.	Percent
Improved traffic management	44	63	20	80	14	48
Cargo tracking to schedule truck arrivals	18	33	13	52	5	17
Computerized rail control techniques	19	35	15	60	4	14

demands placed upon marine terminals and their access routes. *The committee recommends that terminal operators, users, and labor representatives collaborate to find ways to increase the hours of terminal operations at an affordable cost, to coordinate schedules to minimize traffic conflicts, and to alter ship-loading schedules to minimize last-minute peak demands on terminal facilities. Ship lines and drayage operators should also streamline equipment interchange procedures, automate paperwork, and apply information-based technologies to increase the efficiency of terminal use and reduce peak demands on the surface transportation system.*

NOTE

1 The AAPA survey question specifically asks about "on-dock" and "off-dock" rail, although in the U.S. context, this usually refers to having rail service within the marine terminal or adjacent to it. U.S. terminals do not have rail service on the dock that permits terminal cranes to move containers directly from the ship to a rail car.

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Appendix A

Results of Survey on Landside Access by American Association of Port Authorities

The following survey, mailed by the American Association of Port Authorities (AAPA) to 85 member ports in the United States, received 54 responses. The surveys were mailed to and filled out by officials at public port authorities. The actual questions are provided, as are responses to the questions providing optional answers. In a few cases the survey requested open-ended answers that could be summarized by a few responses, and these answers are also provided. Many of the survey questions requested that respondents answer "strongly yes," "yes overall," "yes and no," "no overall," "strongly no," "don't know," or "not applicable." The interpretation of some these responses is unclear. The differences between a "strong no" and a "no overall" or a "strong yes" and a "yes overall" are not obvious in the context of the questions. In summarizing these data in the tables of the report, the committee has combined the responses in a way that avoids ambiguity; thus, the "strong yes" and "yes overall" responses are combined and interpreted to be affirmative answers and the "strong no" and "no overall" are combined and interpreted to be negative answers. The "yes and no" responses are not combined with the affirmative or negative answers in the tables used in the report, but they are provided below for reference. In a few cases the respondents did not provide any answer, even when the option of "not applicable" was available; the summary indicates the number of such responses with "NR."

Although the committee was well aware of problems with the questionnaire and the interpretation of the data, it has used the results because of the lack of other data or information. It has been conservative in its interpretation of the results in the body of the report and has striven to balance the perspectives of port officials with those of others concerned about and influenced by the transportation system.

Not included are several questions about passenger vehicle access to terminals serving passenger ferries. Also not included are questions requesting detailed maps or additional written responses. Few respondents actually provided detailed maps.

LANDSIDE ACCESS TO PORTS

For open-ended questions, please provide a short response.

Two types of scaled responses are used for most of the questions: the first is self-explanatory, i.e., "Circle one: Always Usually Sometimes Rarely Never NA." "NA" means "not applicable"; "DK" means "don't know."

The meaning of the other scaled response—"Circle one: YES yes y/n no NO DK NA"—is

"YES"—strongly yes
"yes"—yes overall
"y/n"—yes and no
"no" —no overall
"NO" —strongly no
"DK" —don't know
"NA"—not applicable

Land Use Impediments

1. (a) Has there been a growth in noncargo activities in the port area in the last 10 years?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	16	16	1	10	4	0	2	5	54
Percentage	29.6	29.6	1.9	18.5	7.4	0	1.9	9.3	100

(b) What is the approximate distribution of port income and land commitment in terms of the following land use categories: [Responses provided for answer to percentage of income from maritime cargo, because few other answers were provided in other categories.]

Percent of Port Income in Maritime Cargo	*No. Ports*
No response	2
Less than 50	4
50–75	10
76–95	17
96–100	21
Total	54

2. Has the development of noncargo activities in the port area substantially increased the value of port property?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	11	12	6	13	7	0	5	54
Percentage	20.4	22.2	11.1	24.1	13.0	0	9.3	100

3. Has competition for available land increased?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	17	23	6	4	3	0	1	54
Percentage	31.5	42.6	11.1	7.4	5.6	0	1.9	100

4. Has lack of available land suitable for development restricted port-related access improvements?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	6	11	8	23	6	0	0	54
Percentage	11.1	20.4	14.8	42.6	11.1	0	0	100

5. Are landfill operations feasible for your port area to create additional land for expanding cargo operations or providing port access?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	11	14	6	9	13	0	0	1	54
Percentage	20.4	25.9	11.1	16.7	24.0	0	0	1.9	100

6. Are rights-of-way available for new port access routes?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	6	16	10	11	5	3	2	54
Percentage	11.1	29.6	18.5	22.2	9.3	5.6	3.7	100

. Are freight-only roads from highways to port terminals a viable op-
on at your port considering all local group concerns?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	1	6	12	14	20	0	2	54
Percentage	1.9	11.1	20.4	25.9	37.0	0	3.7	100

. Are there viable options for consolidated rail/truck corridors to port
acilities?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	6	7	8	17	10	0	6	54
Percentage	11.1	13.0	14.8	31.5	18.5	0	11.1	100

. Are inland cargo consolidation ports a viable and feasible method for
educing congestion in port areas?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	3	15	8	9	9	3	7	54
Percentage	5.6	27.8	14.8	16.7	16.7	5.6	13.0	100

Regulatory Impediments

0. Are there regulations in place or proposed that restrict rail opera-
ions to specific hours of the day in your community?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	3	3	4	15	27	0	2	54
Percentage	5.6	5.6	7.4	27.8	50.0	0	3.7	100

1. Are there regulations in place or proposed that restrict truck opera-
ions to specific hours of the day in your community?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	1	5	3	19	26	0	0	54
Percentage	1.9	9.3	5.6	35.2	48.1	0	0	100

2. (a) Is there coordination in the permitting process for the Clean
Water Act?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	13	14	9	7	3	7	1	54
Percentage	24.1	25.9	16.7	13.0	5.6	13	1.9	100

(b) If yes, what organization is performing the coordination?

(c) Is this process working well?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	3	12	9	2	7	6	0	24	54
Percentage	5.6	24.1	16.7	3.7	5.6	13.0	7.4	44.4	100

13. How do environmental permit procedures impact the provision of port access improvements?

14. Have wetlands regulations impeded the development of access improvements to your port facilities?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*DK*	*NA*	*NR*	*Total*
Number	6	5	16	10	8	3	4	2	54
Percentage	11.1	9.3	29.6	18.5	14.8	5.6	7.4	3.7	100

15. (a) Is additional deregulation needed in the transportation industry?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	2	3	8	15	13	7	4	2	54
Percentage	3.7	5.6	14.8	27.8	24.1	13.0	7.4	3.7	100

(b) If yes, what area of deregulation is needed that would assist in providing better port access?

16. Are special operating permits issued to vehicles in your state that are rendered overweight by the transport of international containerized cargo?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	10	12	7	12	3	5	3	2	54
Percentage	18.5	22.2	13.0	22.2	5.6	9.3	5.6	3.7	100

17. (a) Do the states in which competing ports are located issue special operating permits for container-carrying vehicles at prices, or at allowable weights, that attract traffic from your port?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	8	8	6	14	3	8	5	2	54
Percentage	14.8	14.8	11.1	25.9	5.6	14.8	9.3	3.7	100

(b) Please describe the provisions of these special permits that make these transportation movements through other states more desirable.

18. Do the local or state law enforcement agencies enforce truck weight restrictions and other safety related regulations?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	23	22	5	1	0	0	1	2	54
Percentage	42.6	40.7	9.3	1.9	0	0	1.9	3.7	100

Physical Impediments

19. (a) Are operating constraints imposed by labor contracts the major restriction to operational solutions to congestion problems?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	4	4	8	19	13	1	3	2	54
Percentage	7.4	7.4	14.8	35.2	24.1	1.9	5.6	3.7	100

(b) Would changes in the hours of your port's operation significantly reduce congestion problems to the port?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	2	11	9	10	14	0	6	2	54
Percentage	3.7	20.4	16.7	18.5	25.9	0	11.1	3.7	100

20. (a) Are tunnel and bridge clearances sufficient to accommodate double-stack trains carrying two high-cube (9 ft 6 in. high) containers?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	11	9	4	4	8	5	11	2	54
Percentage	20.4	16.7	7.4	7.4	14.8	9.3	20.4	3.7	100

(b) Can clearances allow double-stack trains carrying one high-cube container stacked on a conventional 9-ft-high container?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	12	11	2	5	4	5	13	2	54
Percentage	22.2	20.4	3.7	9.3	7.4	9.3	24.1	3.7	100

(c) Can clearances allow double-stack trains carrying one high-cube container stacked on a conventional 8 ft 6 in. high container?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	12	12	3	2	4	5	13	3	54
Percentage	22.2	22.2	5.6	3.7	7.4	9.3	24.1	5.6	100

21. (a) Does the condition of rail tracks used for port cargo within your port region restrict the efficiency of rail access?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	3	1	13	20	12	2	1	2	54
Percentage	5.6	1.9	24.1	37.0	22.2	3.7	1.9	3.7	100

(b) Does the condition of rail tracks adjacent to your port region restrict the efficiency of rail access to your port?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	2	1	11	19	11	2	4	4	54
Percentage	3.7	1.9	20.4	35.2	20.4	3.7	7.4	7.4	100

22. Are any rail tracks located within the rights-of-way of public streets?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	18	16	3	7	5	2	2	1	54
Percentage	33.3	29.6	5.6	13.0	9.3	3.7	3.7	1.9	100

23. (a) Do the rail tracks that serve the port have numerous at-grade highway crossings that reduce the efficiency of rail access?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	12	13	8	13	5	0	2	1	54
Percentage	22.2	24.1	14.8	24.1	9.3	0	3.7	1.9	100

(b) If the answer is yes, are there any plans to relocate the tracks within a restricted-access rail corridor or reconstruct at-grade crossings and separated crossings? [Only valid "YES" or "yes" to 23(a) recorded.]

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	1	6	1	10	7	0	0	25

(c) If the answer is yes, when is this construction scheduled to occur?

24. (a) Does a belt-line railroad serve the port?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	9	11	1	10	20	0	2	1	54
Percentage	16.7	20.4	1.9	18.5	37.0	0	3.7	1.9	100

(b) If the answer is yes, does the port own the belt line? [Only valid "YES" or "yes" to 24(a) recorded.]

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	2	4	2	5	7	0	0	20

25. (a) Do street signs clearly direct nonlocal truckers from major arterials and freeways to marine terminals?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	8	26	11	4	3	1	0	1	54
Percentage	14.8	48.1	20.4	7.4	5.6	1.9	0	1.9	100

(b) What are truckers' most frequent complaints about street signs?

6. Are there adequate radii at street intersections to accommodate the urning movements of commercial motor vehicles serving the port?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	8	35	8	2	0	0	0	1	54
Percentage	14.8	64.8	14.8	3.7	0	0	0	1.9	100

27. (a) Are there clearly marked or designated truck routes in and adjoining your port area?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	19	5	4	1	7	1	0	16	54
Percentage	35.2	9.3	7.4	1.9	13.0	1.9	0	29.6	100

(b) Are the truck routes to the port capable of handling all truck weights that can move legally on the Interstate system?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	22	25	3	1	1	0	0	2	54
Percentage	40.7	46.3	5.6	1.9	1.9	0	0	3.7	100

(c) Are intercity roads designated as truck routes also heavily used by passenger traffic with resulting congestion, delays, and safety problems?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	12	15	12	7	0	5	1	2	54
Percentage	22.2	27.8	22.2	13.0	0	9.3	1.9	3.7	100

(d) Have roads that were once used for passenger traffic become increasingly used by trucks?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	6	11	21	8	1	2	3	2	54
Percentage	11.1	20.4	38.9	14.8	1.9	3.7	5.6	3.7	100

(e) What attempts have been made to reduce these transportation conflicts?

28. (a) Are there any bridges posted for lower weight limits on designated truck routes serving your ports?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	2	5	1	26	15	2	2	1	54
Percentage	3.7	9.3	1.9	48.1	27.8	3.7	3.7	1.9	100

(b) If the answer is yes, are there any plans for reconstructing or replacing the bridge(s)? [Too few responses for meaningful summary.]

(c) If the answer is yes, when is this bridge construction scheduled to occur?

29. (a) Are there drawbridges in the port area?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	17	11	1	10	13	0	0	2	54
Percentage	31.5	20.4	1.9	18.5	24.1	0	0	3.7	100

(b) If the answer is yes, do they cause congestion into the port?

	Always	*Usually*	*Sometimes*	*Rarely*	*Never*	*NA*	*NR*	*Total*
Number	6	1	11	6	3	0	1	27

30. (a) Are key general cargo and intermodal port and transportation facilities located within easy access of each other?

	Always	*Usually*	*Sometimes*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	14	23	8	1	0	7	0	1	54
Percentage	25.9	42.6	14.8	1.9	0	13.0	0	1.9	100

(b) On average, how many traffic lanes exist on the roadways that connect these terminals?

	Two	*Four or more*	*Other*	*NR*	*Total*
Number	15	25	2	12	54
Percentage	27.8	46.3	3.7	22.2	100

31. If your port handles cargo transported by rail, how far are the rail lines from the general cargo and container terminals?

	Adjacent	*More than 1 mi*	*Other*	*NR*	*Total*
Number	37	12	1	2	54
Percentage	68.5	22.2	1.9	3.7	100

32. If your port is served by intermodal terminals (e.g., rail-highway terminals, inland port facilities), how far are these intermodal terminals from their main serving port terminals?

	Adjacent	*More than 25 mi*	*Less than 25 mi*	*NA*	*Other*	*NR*	*Total*
Number	6	4	19	16	2	6	54
Percentage	11.1	7.4	35.2	29.6	3.7	11.1	100

33. (a) Are there on-dock (i.e., on-terminal) or off-dock rail terminals at your port?

	Yes	*No*	*NA*	*NR*	*Total*
Number	34	12	4	4	54
Percentage	63.0	22.2	7.4	7.4	100

(c) How far are the off-dock terminals from feeder terminals?

(d) Are there any plans to construct on-dock or off-dock intermodal transfer facilities?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	8	9	3	17	8	1	2	6	54
Percentage	14.8	16.7	5.6	31.5	14.8	1.9	3.7	11.1	100

(e) If the answer is yes, please describe the nature and type of these improvements and their estimated costs.

34. Would off-dock intermodal transfer facilities expedite cargo flows more efficiently than on-dock facilities?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	3	9	9	14	6	4	8	1	54
Percentage	5.6	16.7	16.7	25.9	11.1	7.4	14.8	1.9	100

35. (a) Would traffic-related improvements to highways in the port area be subject to even more passenger traffic in the future?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	13	15	13	8	3	1	0	1	54
Percentage	24.1	27.8	24.1	14.8	5.6	1.9	0	1.9	100

(b) If the answer is "sometimes," "usually," or "always," what could be done to mitigate this situation in the future?

36. (a) Can the following technological solutions improve highway and rail access to your port?

(1) Improved traffic management

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	11	23	3	12	2	2	0	1	54
Percentage	20.4	42.6	5.6	22.2	3.7	3.7	0	1.9	100

(2) Cargo tracking to schedule truck arrivals

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	3	15	8	20	3	2	2	1	54
Percentage	5.6	27.8	14.8	37.0	5.6	3.7	3.7	1.9	100

(3) Computerized rail control techniques

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	5	14	9	15	3	3	4	1	54
Percentage	9.3	25.9	16.7	27.8	5.6	5.6	7.4	1.9	100

(b) If available, what would be the approximate cost of instituting such systems?

(c) To what extent would these cargo management techniques offset the need for more costly infrastructure improvements?

	Help Some	*No Help*	*DK*	*NA*	*Other*	*NR*	*Total*
Number	12	2	6	12	1	21	54
Percentage	22.2	3.7	11.1	22.2	1.9	38.9	100

37. (a) Are automated customs systems used at your port?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	9	15	5	13	10	1	0	1	54
Percentage	16.7	27.8	9.3	24.1	18.5	1.9	0	1.9	100

(b) If so, do these systems have an impact on reducing access time to ports as well as in ports? [Only valid "YES" or "yes" to 37(a) recorded.]

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	0	8	4	2	0	3	4	0	20

38. (a) Is barge use a feasible solution to landside congestion?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	3	10	5	21	9	1	4	1	54
Percentage	5.6	18.5	9.3	38.9	16.7	1.9	7.4	1.9	100

(b) If yes, briefly explain.

39. Please complete the table below answering the following questions:

(a) How far is the closest Interstate to your port terminal(s)?

(b) How many lanes are open to traffic on the roadways that connect the port terminal(s) with the Interstate?

(c) Is parking allowed on these roadways? (Yes or No)

(d) What type of land use best characterizes the areas through which these roadways pass? (Industrial, commercial, residential, mixed use, etc.)

Maximum distance of any port terminal from Interstate (mi)

	Less than 1	*1–5*	*6–10*	*More than 10*	*NR*	*Total*
Number	13	26	8	6	1	54
Percentage	24.1	48.1	14.8	11.1	1.9	100

Coordination Impediments

40. Does your port have a staff person assigned to coordinate port access needs with state and local transportation authorities?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	12	19	8	9	2	0	1	3	54
Percentage	22.2	35.2	14.8	16.7	3.7	0	1.9	5.6	100

41. (a) What are the formal, ongoing mechanisms for meetings with local modal representatives? (port associations, transportation roundtables, planning forums, etc.)

(b) How frequently do these meetings take place? (days, weeks, etc.)

Mechanisms	*Meeting Frequency*
_____	_____
_____	_____
_____	_____

42. (a) Has *required* coordination with federal, state, and local agencies impeded improvement projects for landside access to ports?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	0	5	9	20	4	3	11	2	54
Percentage	0	9.3	16.7	37.0	7.4	5.6	20.4	5.6	100

(b) If "sometimes," "usually," or "always," please describe.

43. (a) Do metropolitan planning organizations or regional agencies serve a coordinating function for your ports?

Summary of written responses

	YES	*No*	*Yes, but not effective*	*DK*	*NR*	*Total*
Number	26	17	6	3	12	54
Percentage	48.1	31.5	11.1	5.6	22.2	100

(b) If neither, what mechanisms exist for local governmental coordination with ports in developing projects that may affect access to ports?

44. Does the state transportation department coordinate activities such as road construction with ports; i.e., is there any intermodal coordination at the state level?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	5	17	13	9	2	2	5	1	54
Percentage	9.3	31.5	24.1	16.7	3.7	3.7	9.3	1.9	100

45. (a) Is there a transportation trust fund, i.e., an ongoing dedicated fund, or a dedicated gas tax for transportation improvements in your state?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	24	22	0	3	1	1	1	2	54
Percentage	44.4	40.7	0	5.6	1.9	1.9	1.9	3.7	100

(b) If yes, does it provide funding for
(1) Rail projects?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	1	4	9	11	12	1	9	0	46
Percentage	2.2	8.7	19.6	21.7	26.1	2.2	19.6	0	100

(2) Port development projects?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	4	7	6	10	17	1	1	0	46
Percentage	8.7	15.2	13.0	21.7	37.0	2.2	2.2	0	100

(3) Port access projects?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	2	9	19	7	6	1	1	1	46
Percentage	4.4	19.6	41.3	15.2	13.0	2.2	2.2	2.2	100

(c) If no, what state funds are available for rail and port improvements?

46. How is funding for landside access improvements obtained?

47. (a) Are there strategic plans at the state or local level that incorporate intermodal transportation considerations?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	8	17	6	6	6	9	1	1	54
Percentage	14.8	31.5	11.1	11.1	11.1	16.7	1.9	1.9	100

(b) What are the titles of these strategic plans and by what state or local agency were these plans developed?

(c) Have these plans been implemented and to what extent (estimate by percent of total implementation).

48. With government funding prospects limited in the future, to what extent will private/public and local/state/federal partnerships provide funding for future port access funding questions?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	4	8	12	7	0	0	21	2	54
Percentage	7.4	14.8	22.2	13.0	0	0	38.9	3.7	100

Defense-Related Access

49. Does hazardous material and military traffic have to use passages through congested urban areas?

	Always	*Usually*	*Some-times*	*Rarely*	*Never*	*NA*	*DK*	*NR*	*Total*
Number	11	11	14	9	2	3	3	1	54
Percentage	20.4	20.4	25.9	16.7	3.7	5.6	5.6	1.9	100

50. (a) Has your port handled cargo in support of Operation Desert Shield?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	12	2	0	12	22	3	1	2	54
Percentage	22.2	3.7	0	22.2	40.7	5.6	1.9	3.7	100

(b) If yes, has the movement of military cargo put a strain on normal commercial operations at the terminals that handled the cargo for Desert Shield?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NR*	*Total*
Number	1	2	1	5	4	0	1	14

(c) Has the movement of military cargo in certain terminals caused access problems to normal operations at other terminals?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*Total*
Number	2	3	1	11	14	3	9	42
Percentage	4.8	7.1	2.4	26.2	33.1	7.1	19.0	100

51. (a) Does your port handle hazardous materials including military explosives?

	YES	*yes*	*y/n*	*no*	*NO*	*DK*	*NA*	*NR*	*Total*
Number	5	16	6	8	15	0	0	1	54
Percentage	9.3	29.6	11.1	14.8	27.8	0	0	1.9	100

(b) Are hazardous material exemptions a problem?

	NO	*Some*	*DK*	*Other*	*NR*	*Total*
Number	27	4	6	8	9	54
Percentage	50.0	7.4	1.9	14.8	16.7	100

52. Would military cargoes encounter any access impediments to your port?

	NO	*Some*	*DK*	*Other*	*NR*	*Total*
Number	40	8	1	0	5	54
Percentage	74.1	14.8	1.9	0	9.3	100

Appendix B

Survey of Inland Terminal Operators

PREFACE

The material in this appendix comes from a survey of terminal operators on the nation's rivers and inland waterways. The survey questionnaires were mailed to members of Inland Rivers Ports and Terminals, Inc., and the Pacific Northwest Waterways Association. Only 24 percent of the questionnaires were returned, however, which raised the concern that those terminal operators with access problems were more likely to respond than those without problems. For example, two terminal operators from the St. Louis area completed surveys indicating extensive access problems that were not apparent to the U.S. Department of Transportation study team that visited several other terminals in the St. Louis area. The study committee concluded that the survey results were not representative and therefore decided not to include the results in the report. The appendix examines a subsample of the returned questionnaires; the subsample includes terminals in urbanized areas, which, presumably, would have access problems similar to those of ports in coastal cities. The committee agreed that it would be useful to include this material because so little information is available about the access problems of terminals on the inland waterways and rivers. The committee believes, however, that the results should be interpreted as a collection of case studies and not as a valid sample about which inferences can be drawn about the access problems experienced by the population of inland waterways and river terminals as a whole.

Survey of Inland Terminal Operators

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he U.S. Department of Transportation's (DOT's) Maritime Administration, in an effort to address the landside access issues at bulk cargo ports and terminals, initiated a two-stage data collection effort. As in Phase I, the DOT interagency team conducted a series of on-site port visits to discuss the access problems with terminal operators, primarily those handling bulk commodities.

The study team also elicited the support of Inland Rivers Ports and erminals, Inc. (IRPT) and the Pacific Northwest Waterways Association (PNWA) in distributing a survey to their inland terminal operator membership. IRPT distributed 235 questionnaires, and PNWA sent 58. The response rate to the survey overall was 24 percent, a rate judged insufficient to draw statistically reliable conclusions about all inland terminal operators. Nevertheless, the information in the surveys was considered valuable; it can be treated in much the way that case study information is handled—that is, instructive and informative about the landside access problems of inland terminal operators, but not necessarily representative of the population.

The analysis of this survey was based on certain defined assumptions. Primarily, the responses of terminal operators in urban areas, defined as incorporated areas with at least 50,000 total population, were considered. In addition, each river system was to be represented by at least one respondent. Finally, in order to address any differences in answers because of cargo handling differences, the major commodity categories (coal, grain, and fertilizers) were represented.

On the basis of these three assumptions, the 68 respondents were screened to find those terminals fitting the foregoing criteria. Attention was ultimately focused on 17 respondents. The 17 terminals were distributed as follows: Upper Mississippi River system (6), Ohio River system (1), Tennessee River system (1), Arkansas River system (1), Missouri River system (2), Kanawhe River system (1), Warrior/Tombigbee River system (1), Mobile River system (1), Alabama River system (1), and Columbia River system (2).

The following sections of this analysis are devoted to a discussion of the landside access problems of these inland terminals. Some com-

ments are presented about the responses of all 17 operators; others are directed toward the responses of individual terminal operators. The main topics covered parallel those discussed in the Transportation Research Board report on general cargo coastal ports. As stated, the issues discussed include physical access, land use, regulatory, and institutional impediments.

This report provides no discussion of the results of the IRPT/PNWA survey from the nonurban inland terminal operators in order to focus on results most comparable to the situation of the coastal ports. A subsequent report will demonstrate that the nonurban inland terminal operators also experience landside access problems in each of the four major categories of impediment.[1] The following sections of this appendix discuss how the 17 urban inland terminals are affected by each of the landside access impediment categories. Before that discussion a brief summary of the questionnaire evaluation methodology will be presented.

EVALUATION METHODOLOGY

Survey responses were distributed along a 6-point Leikert scale: 1 = adequate, 3 = moderately inadequate, and 6 = very inadequate. For terminal operators to qualify as having an access impediment in any one of the four major landside access impediment categories, they had to indicate on the questionnaire that a particular issue had, for example, a more-than-moderate impact on terminal efficiency and access: specifically, they had to answer the individual question with a 4, 5, or 6. The specific definition of each landside access impediment category and the underlying questions used to define it will be explained in the following.

PHYSICAL ACCESS ISSUES

Several infrastructure impediments are associated with roadway and railway access to ports and terminals. These site-specific barriers increase the costs and time of moving goods to and from ports and terminals. For roadways, they involve insufficient capacities, design inadequacies, and signing and marking deficiencies. For railways, they entail poorly maintained track and conflicts caused by at-grade crossings. This section will cover both the roadway and the railway access issues in turn for the 17 urban inland terminal operators. Initially, case-study evidence of issues will be presented. This will be followed by a summary of the overall response.

Roadway Access Issues

As stated, the roadway access impediments adversely affecting port operations can be grouped into the following categories: capacity inadequacies, design inadequacies, and signing and marking inadequacies.

For example, the roadways serving ports or terminals can have capacity inadequacies stemming from the inability to meet traffic demands, or the inadequacies may be due to traffic impediments as a consequence of rawbridges. The roadway access to ports may also be impeded by design deficiencies, a prominent one being roadway intersection design that 's inadequate to accommodate the turning movements of trucks serving he port or terminal area. A third category of roadway access impediments concerns signing or marking inadequacies.

The IRPT/PNWA survey among inland terminal operators uncovered those with roadway access problems in each of the major categories utlined above. The following summarizes the roadway access problems xperienced by five of the urban inland terminal operators.

Case 1: Little Rock, Arkansas

A terminal operator in Little Rock, Arkansas, reported that the current highway access available to trucks serving the terminal is very inadequate. The operator identified the inability of the radii at street intersections to accommodate turning movements of trucks as the main source of the problem.

Case 2: St. Louis, Missouri

An operator in St. Louis, Missouri, complained that trucks traveling to and from the terminal experience a high level of traffic congestion. The operator attributes much of the problem to the poor maintenance (and consequent potholes) on the current highway access roads. This operator noted that the turning radii on street intersections were inadequate to handle truck movements serving the port terminal area. This operator also reported that there were no clearly marked or designated truck routes in and adjoining the port terminal area.

Case 3: St. Louis, Missouri

A second terminal surveyed in St. Louis noted that it handled liquid chemicals and oils. Its operator characterized the highway access avail-

able to trucks serving the terminal as inadequate. This was attributed, in large measure, to a moderate level of traffic congestion coupled with a moderately inadequate ability to handle the turning movements of trucks at street intersections. Contributing to the roadway access problem is the lack of clearly marked or designated truck routes in and adjoining the port terminal area, the same factor noted by the other St. Louis respondent.

Case 4: Mobile, Alabama

The terminal operator in Mobile, Alabama, has the largest cargo volume among the 17 urban terminals discussed in this appendix. This operator handles 8.4 million tons of coal, 1.9 million tons of forest products, 1.3 million tons of iron ore, and 1.0 million tons of steel. The current highway access available to trucks serving the terminal is inadequate because of slightly greater than moderate traffic congestion experienced by trucks traveling to and from the terminal as well as more than moderately inadequate street intersections for accommodating truck turning movements. This operator also notes that the roadway capacity is hindered by drawbridges in the terminal area that impede efficient service. Finally, this operator indicates that there are not clearly marked or designated truck routes in the port terminal area.

Case 5: Portland, Oregon

This operator of a bulk grain terminal in Portland, Oregon, states that the current highway access available to trucks serving the terminal area is somewhat more than moderately inadequate. This deficiency results from a more-than-moderate amount of traffic congestion experienced by trucks traveling to and from his terminal. It is important to note that trucks must travel 6.5 mi from the terminal to reach either an Interstate highway or a four-lane truck route. In the American Association of Port Authorities (AAPA) survey, most ports were less than 2 mi from an Interstate.

Summary

These five case studies from the inland operators indicate the range of roadway access impediments noted by the operators. Table B-1 summarizes the roadway access impediments of the 17 urban inland terminal

TABLE B-1 Urban Inland Terminal Operator Survey: Physical Access Issues—Roadway Impediments

	Roadway Impediments				
	Capacity Limits				
Terminal	General	Congestion	Draw-bridge	Design Problems	Sign Inadequacies
1	X				X
2	X			X	
3					
4					
5					
6		X			
7				X	
8					
9					
10		X		X	X
11				X	X
12		X			
13					
14					
15	X	X	X	X	X
16	X	X			
17				X	

NOTE: X-indicators follow. *General capacity limits*: more than moderately inadequate highway access available to trucks serving terminal. *Congestion*: more than moderate level of traffic congestion experienced by trucks serving terminal. *Drawbridge*: drawbridges on rail or truck routes serving terminal impede service. *Design problems*: more than moderately inadequate radii at street intersections. *Sign inadequacies*: no clearly marked or designated truck routes in and adjoining terminal area.

operators. It details the specific items on the questionnaire used to categorize a particular terminal operator as having a roadway access impediment due to capacity limits, design problems, or signing inadequacies.

As shown, 10 of the 17 terminals had one or more roadway access impediments. Seven of the terminals had an impediment resulting from highway capacity limitations, six had impediments as a consequence of design problems, and four reported sign inadequacies.

Railway Access Issues

Although railroads may be viewed as an alternative to highways in order to improve landside access to ports, several factors may harm the efficiency of the rail mode. In the IRPT/PNWA survey, operators were asked whether the condition of rail tracks in their terminal areas affected the efficiency of rail access. In addition, the operators were asked about the existence of rail lines intersecting local roads with at-grade crossings as well as their impact on the efficiency of rail access. Three case studies will be presented to illustrate this issue.

Case 1: St. Louis, Missouri

An inland terminal operator in St. Louis indicated that the condition of rail tracks directly serving the port terminal area significantly restricts the efficiency of rail access. In addition, this operator noted that the rail tracks serving the terminal have one or more at-grade highway crossings of truck routes. Furthermore, these crossings, according to the terminal operator, have a significantly negative impact on rail access efficiency.

Case 2: Little Rock, Arkansas

The inland terminal operator surveyed in Little Rock complained that the condition of rail tracks directly serving the terminal resulted in a more-than-moderate restriction on the efficiency of rail access. This operator, however, did not think that the at-grade crossings between rail lines and truck routes negatively affected the efficiency of rail access to the terminal.

Case 3: Kansas City, Missouri

The operator of a fertilizer, petroleum coke, and feed ingredient terminal in Kansas City, Missouri, stated that the at-grade crossings between truck routes and rail lines had a significant negative impact on the efficiency of rail access to the terminal. The negative consequences of the at-grade crossings overshadowed his belief that the condition of rail tracks moderately restricted rail access to his terminal.

Summary

These three case studies indicate the range of railway access deficiencies reported. Table B-2 summarizes the railway access impediments of the 17

TABLE B-2 Urban Inland Terminal Operator Survey: Physical Access Issues—Railway Impediments

	Rail Impediments		
Terminal	Track Condition	At-Grade Crossings	Adverse Impact
1			
2	X	X	
3		X	
4			
5			
6		X	
7			
8			
9		X	
10	X	X	X
11		X	X
12			
13			
14			
15		X	
16		X	
17		X	

NOTE: X-indicators follow. *Track condition*: condition of rail tracks more than moderately restricts rail access efficiency. *At-grade crossings*: rail tracks serving terminal have one or more at-grade crossings with truck routes. *Adverse impact*: more than moderately negative impact of at-grade crossings on rail access efficiency.

operators. It describes the specific items on the questionnaire used to denote a particular operator as having a railway access impediment due to general track condition, the existence of at-grade crossings with truck routes, and the assertion of negative effects of at-grade crossings on efficiency.

As shown in Table B-2, 9 of the 17 operators had at-grade crossings between rail lines and truck routes in their terminal areas. Two also reported that general rail track conditions had more than a moderate restriction on the efficiency of rail access in the terminal. In addition, two terminals responded that their at-grade crossings between rail lines and truck routes caused a more-than-moderately negative impact on rail access efficiency.

The inland terminal operators were asked the following series of questions about the land use impediments in their terminal areas: (a) How would you characterize the growth of noncargo activities during the past 10 years? (b) How would you describe the competition for available land around the terminals during the past 10 years? and (c) How would you assess changes in property values in the port area during the past 10 years? Several inland terminal operators indicated that during the past 10 years there had been a significant growth in noncargo activities coupled with a corresponding increase in competition for available land and increase in the price of that property. Following are examples of these issues.

Case 1: Davenport, Iowa

A bulk terminal operator in Davenport, Iowa, indicated that during the past 10 years there had been a significant growth in noncargo activities around the terminal area. As a consequence, the operator noted an increase in competition for available land and an increase in property value.

Case 2: Charleston, West Virginia

A bulk terminal operator in Charleston, West Virginia, has witnessed during the past 10 years a significant increase in competition for available land as well as a significant increase in property value around the terminal area. This operator, however, only noted a less-than-moderate growth in noncargo activities around the terminal area.

Case 3: Vancouver, Washington

The terminal operator in Vancouver, Washington, found that during the past 10 years slightly more than a moderate growth in noncargo activities was accompanied by a moderate increase in competition for available land. However, this operator did not believe that the increase in property values in the port area was substantial.

Summary

These case studies show the extent of land use impediments noted in the surveys. Table B-3 summarizes the land use impediments of the 17 urban

TABLE B-3 Urban Inland Terminal Operator Survey: Land Use Issues

Terminal	Land Use Issues		
	Noncargo Growth	Competition for Land	Change in Land Value
1			
2			
3			
4	X	X	X
5			
6		X	X
7			
8	X		X
9		X	X
10			X
11			
12	X	X	X
13			
14	X	X	
15	X	X	
16		X	X
17	X	X	X

NOTE: X-indicators follow. *Noncargo growth*: more than moderate growth of noncargo activities at terminal in past 10 years. *Competition for land*: more than moderate competition for land around terminal in past 10 years. *Change in land value*: land values more than moderately increased in past 10 years.

inland terminal operators. It describes the questionnaire items used to group a terminal operator as having a land use impediment due to growth in noncargo activities, competition for land in the terminal area, and an increase in land value. As shown, 10 of the 17 ports said that they had more than a moderate impact from one of these three factors.

Land Use Solution Opportunities

The survey of inland terminal operators explored some possibilities that would reduce congestion and land use problems at terminals. The options presented included the use of barges, pipelines, and conveyors. Obviously, all three options would reduce traffic flows on current roadways and railways and thereby alleviate congestion or remove expansion projects from the planning stages. However, both pipelines and con-

veyors would require right-of-way access, although they could possibly share right-of-way with existing infrastructure and require less need for additional land.

The following paragraphs summarize some of the inland terminal operators who noted that some or all of the alternatives presented were very effective in reducing their congestion and land use problems.

Case 1: Charleston, West Virginia

The terminal operator in Charleston, who noted a particularly significant land use impediment problem, believes that barges and conveyors offered very effective solutions to the terminal congestion and land use problems confronting the terminal.

Case 2: St. Louis, Missouri

Two terminal operators in St. Louis identified some of the proposed land use opportunities as being very effective in reducing problems. One operator, who currently uses barges in his terminal operations, believes that conveyor use would be very effective in reducing congestion. A second terminal operator also thinks that barges would reduce congestion and land use problems in the terminal area.

Summary

The inland terminal operator survey shows that the land use problems presented can be mitigated by the consideration of alternative access systems that do not depend on street or railway rights-of-way. As such, these choices may reduce the demand for land for access problems or reduce congestion on available rights-of-way. All three options received support as very effective methods of reducing land use problems in terminal areas.

REGULATORY ISSUES

The IRPT/PNWA survey of inland bulk terminal operators explored two types of regulatory impediment that could harm landside access improvement projects. The survey asked ports whether their communities had restrictions in place or proposed that would limit truck or rail operations. These restrictions could stem from either noise or air-quality considerations.

A second regulatory impediment question concerned the extent to which the U.S. Army Corps of Engineers' regulations affected terminal operators' plans to improve transportation movements and capacity at the terminal.

There was evidence among the inland terminal operators that regulatory restrictions did impede the efficiency or implementation of access improvements.

One terminal operator in St. Louis noted that the terminal faced in-place community regulations that restricted truck service to the terminal to specific hours of the day.

However, the inland terminal operators expressed greater concern about the negative impact of Corps of Engineers' regulations on improvement projects. An inland terminal operator in St. Louis and one in Kansas City expressed the opinion that the Corps of Engineers' regulations significantly impeded plans designed to improve transportation movements and terminal capacity. Three other inland terminal operators think that these regulations are a somewhat-more-than-moderate impediment.

Summary

Table B-4 summarizes the information on the magnitude of regulatory impediments among the inland terminal operators. As noted, 6 of the 17 operators had at least one regulatory impediment to terminal efficiency.

INSTITUTIONAL ISSUES

The inland terminal operators were queried about institutional issues. Specifically, they were asked to characterize whether they had experienced any problems with required intergovernmental coordination regarding transportation improvement projects in their terminals. They were also asked the extent to which state DOTs or local metropolitan planning organizations (MPOs) had attempted to contact them about road construction projects that might affect their terminals. A third question investigated whether the terminal operator took the initiative and contacted the planners about their transportation needs.

The questionnaire also investigated the effects of a nongovernment institution (i.e., labor) on terminal operations. The issue of whether labor contracts effectively limited hours of terminal operation was included in the questionnaire. Terminal operators were also asked whether extending terminal operating hours would reduce terminal congestion currently experienced by trucks.

TABLE B-4 Urban Inland Terminal Operator Survey: Regulatory Issues

Terminal	Regulatory Issues	
	Truck Operations	Corps Regulations
1		
2		
3		
4		X
5		
6		
7		
8		
9		
10		X
11		X
12		
13		
14	X	
15		X
16		X
17		

NOTE: X-indicators follow. *Truck operations*: community regulations restrict truck service to specific hours of day. *Corps regulations*: U.S. Army Corps of Engineers regulations more than moderately impede transportation improvement plans.

The following paragraphs reveal that inland terminal operators do experience institutional impediments when contemplating actions to enhance efficiency and improve access.

Case 1: Kansas City, Missouri

A bulk terminal operator in Kansas City indicated that the terminal had extensive problems as a result of required intergovernmental approval for a recently undertaken transportation improvement project in the terminal area. In addition, this operator did experience limitations in the hours of terminal operation as a result of existing labor contracts. However, when asked whether extending operating hours beyond the 8:00

TABLE B-5 Urban Inland Terminal Operator Survey: Institutional Issues

	Institutional Issues			
Terminal	Labor Contracts	Required Coordination	DOT/MPO Contact	Port Contact
1			X	X
2			X	X
3			X	X
4			X	X
5				
6				
7		X	X	X
8		X		
9			X	X
10		X	X	
11	X	X		
12			X	X
13			X	X
14				
15			X	
16			X	X
17				

NOTE: X-indicators follow. *Labor contracts*: labor contracts effectively limit hours of terminal operations. *Required coordination*: more than moderate problem with intergovernmental coordination for terminal improvement projects. *DOT/MPO contact*: terminals have less than some contact with DOTs and MPOs about road construction problems that might affect terminals. *Port contact*: terminals have less than some contact with planners about transportation needs of terminal.

a.m.–to–6:00 p.m. window would reduce truck congestion, the operator responded negatively.

Case 2: St. Louis, Missouri

A terminal operator in St. Louis also experienced significant problems with required intergovernmental coordination and approval for a recently undertaken project. In addition, the operator said that he had no contact with state and local DOTs regarding road construction projects that might affect his terminal. This lack of contact was despite extensive

efforts to contact these agencies about the transportation needs of the terminal.

It is also interesting to note that this terminal operator believed that keeping the terminal operating beyond the normal business day would significantly reduce congestion. The operator did say, however, that existing labor union contracts were not responsible for limiting operating hours.

Summary

In all, 11 of the 17 inland terminal operators stated that state and local agencies had not contacted them about road construction projects that might affect their terminals. Nine of these terminal operators, however, did not take the initiative and attempt to contact these agencies about their transportation needs (Table B-5).

Private and Public Funding for Port Access Projects

The questionnaire included an item asking the inland terminal operators to characterize the prospects for private-public partnerships for funding future port access projects. Several operators characterized such prospects as good, but eight operators believed that such opportunities were nonexistent.

NOTE

1. The complete survey results from all 68 inland terminal operators will be summarized in a report from the Office of Port and Intermodal Development, U.S. Maritime Administration. This report will compare results from the urban and nonurban inland terminal operators in all four landside access impediment categories.

Appendix C

GLOSSARY

Backhaul A carrier's return movement, opposite from the direction in which it earns higher revenue.

Bill of lading Receipt of goods shipped signed by the person (or agent) who contracts to carry them that states the terms on which the goods are carried.

Break-bulk cargo General cargo conventionally stevedored and stowed as opposed to bulk, unitized, or containerized cargo.

Bulk commodities Usually a homogeneous raw material shipped in ship-load lots, for example, grain, chemicals, petroleum products. Usually differentiated by dry and liquid.

Chassis Special trailer or undercarriage on which containers are moved over the road.

Drayage Charge assessed or service for local hauling of cargo.

General cargo A variety of consumer goods, mostly manufactured or processed, and usually shipped on liner cargo or air freight services.

Intermodal Carriage by more than a single mode. In some segments of the freight transportation industry, "intermodal" is defined as the transfer of containers from ship to rail. In this report its

definition includes transfers between all freight modes involved in general cargo transportation (ship, rail, and truck), taken as a system for moving freight from origin to destination by its most efficient means. In the ISTEA the meaning includes passenger trips involving more than one mode.

Land bridge The provision of a cargo movement overland between two separate voyages by sea (a sea-land-sea movement). May also refer to a land-sea-land movement.

Liner service That type of service offered by regular line operators of vessels. The itineraries and sailing schedules are predetermined and fixed, and most of the cargo is containerized general cargo.

Neo-bulk Refers to processed or manufactured goods that move by ship-load lots, such as automobiles or lumber.

Tanker Ship for moving dry or liquid bulk commodities. In U.S. Census Bureau international commerce data, it refers only to liquid bulk.

TEU Twenty-foot equivalent unit. A means of expressing containers of various sizes, such as 20, 40, or 48 ft, in equivalent units.

Ton Expressed in maritime trade as long, short, or metric. A long ton equals 1016 kg, or 2,240 lb. A short ton equals 2,000 lb. A metric ton equals 1000 kg, or 2,205 lb.

Tramp Irregular service afforded by vessels, other than tankers, that are chartered or otherwise hired for the carriage of goods on special voyages. Service is not predetermined or fixed. Most of the cargo is dry bulk, but it also includes general cargo moved in ship-load lots.

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Study Committee Biographical Information

Michael S. Bronzini, *Chairman*, is Director of the Center for Transportation Analysis, Oak Ridge National Laboratory, Tennessee. He received his doctoral and master's degrees in civil engineering from Pennsylvania State University and his bachelor's degree from Stanford. From 1986 until 1990 he was Professor and Head of the Pennsylvania State University Department of Civil Engineering. Before joining the Penn State faculty, he was Professor of Civil Engineering at the University of Tennessee and director of the Transportation Center. An expert in transportation systems and waterway transportation, Dr. Bronzini has published widely on transportation network analysis, water transportation, coal transportation, and transportation economics. His 1984 paper on inland water transportation management, co-written by committee member Craig Philip, won an award for best paper on waterway transportation from the Transportation Research Forum. He served as chairman of the Transportation Research Board's Committee on Inland Water Transportation from 1984 to 1991 and has served on other TRB committees; he is an active member and past president of the Transportation Research Forum.

Anne D. Aylward is Maritime Director, Massachusetts Port Authority (MASSPORT). She received her A.B. from Radcliffe College and her M.A. in city planning from the Massachusetts Institute of Technology. After working for a year as a research associate with MIT, she joined MASSPORT as a planner. She moved into maritime operations after a year. She became Maritime Director in 1983. Ms. Aylward is Chairman of the Board of the American Association of Port Authorities and of the North Atlantic Ports Conference, on the Board of Governors of the Boston Shipping Association, and Vice-Chairman of the Boston Harbor Association.

Charles J. Chodzko is Vice-President of California Cartage Company, the largest intermodal truck carrier on the West Coast. Mr. Chodzko has a B.S. in trade and transportation from the University of Southern California. After graduation he worked for the California Public Utilities Commission as a rate expert for 18 months, where he was licensed as an Interstate Commerce Commission practitioner. In 1952 he joined California Cartage Company working in sales, traffic, and truck safety. He was promoted to Vice-President in 1965. Mr. Chodzko serves on the Harbor Committee of the Los Angeles Chamber of Commerce and is an active member of the Propeller Club at the ports of Los Angeles and Long Beach.

shipper of Perrier mineral waters. Mr. Collins graduated from the Merchant Marine Academy at Kings Point and received an M.B.A. in finance and marketing from Northwestern University. He spent seven years at sea with Lykes Lines. In 1973 he joined Delta Lines as Vice-President/Assistant to the President. In 1979 he joined the Perrier Group as Director of International Transportation for the United States. Mr. Collins was subsequently appointed President of Draco Marine, Ltd. He currently serves as Chairman of the International Transportation Committee of the National Industrial Transportation League and is a former Chairman of the Shippers for Competitive Ocean Transportation and the International Marine Council steering committee.

William J. DeWitt is Vice-President, Automotive Marketing, Burlington Northern Railroad. He received his B.A. from Allegheny College and his M.B.A. in transportation from the University of Tennessee. He has held many positions with BN. He began his career as a carman and brakeman for the South Shore Line/helper in 1966. Since then he has risen through several positions, including Assistant Division Superintendent and Director of Strategic Planning. He has been involved in strategic planning and intermodal issues for BN since 1982. Before assuming his current position, he was Vice-President, Domestic Marketing and Sales, for BN's intermodal unit. Mr. DeWitt is active in several professional organizations, including the American Association of Executives Multi-Level Executive Committee.

Jameson W. Doig is Professor of Politics and Public Affairs at the Woodrow Wilson School, Princeton University. He received his A.B. from Dartmouth University and his M.P.A., M.A., and Ph.D. from Princeton. He was a staff member at the Brookings Institution for 2 years before joining the faculty at Princeton in 1961. In addition to holding a variety of administrative posts with the Woodrow Wilson School, Dr. Doig has published widely on political science and urban public policy. He has written several books including *Metropolitan Transportation Politics and the New York Region*, *The Politics of Urban Regional Development*, and *Urban Politics and Policy Making*.

Frank R. Harder is President of Intermodal Management, Inc. Mr. Harder received his B.S. in physics and his M.B.A. in transportation from the University of Minnesota. After working with Conrail for a short time, Mr. Harder joined PTL Transportation in 1980, one of the largest trucking firms serving cargo ports on the East Coast, and held

ositions in engineering, operations, planning, and sales and marketing. From 1990 to 1992 he served as Vice-President, Marketing, of PTL. In 1992 he founded Intermodal Management, a consulting company specializing in the international intermodal industry. He has been active in he Association of American Railroads' intermodal productivity task orce and on the Transportation Research Board's Intermodal Freight erminal Design Committee.

Jack D. Helton is Vice-President, Government Marketing, for the Sea-Land Services, Inc. He received his B.S. in political science from Texas ech University. Mr. Helton entered the transportation industry by first working for Yellow Freight System from 1959 to 1971 and Time D.C. from 1971 to 1973. In 1974 he joined Lynden Transport, Inc., and in 1977 moved to Sea-Land. He has held a variety of positions in the company, including Port Manager, Seattle; Vice-President and General Manager, Alaska Division; Vice-President, General Manager of North American Land Operations; and Vice-President of Sales, Atlantic ivision.

Marc J. Hershman is Professor and Associate Director, School of Marine Affairs, College of Ocean and Fishery Sciences, University of Washington. He received his A.B. and J.D. from Temple University and pursued L.L.M. study at the University of Miami School of Law. He was on the faculty of Louisiana State University from 1970 to 1976, first as a Research Associate and ultimately as an Associate Professor. He joined the University of Washington faculty in 1976 as an Associate Professor and Adjunct Professor of Law. He achieved his current position in 1987. Dr. Hershman has been active in coastal zone management and planning issues both while at LSU and at Washington. He is founder and editor in hief of the journal *Coastal Management*. He has authored or co-authored several books and articles on coastal zone management, urban orts and harbor management, environmental planning, and other aritime issues.

Roger L. Hulette is retired from his position as President of ORBA Corporation, which specializes in the design, construction, and operation of dry bulk terminal facilities. He received his B.S.C.E. and M.S.C.E. from the University of Kentucky. Mr. Hulette has more than 40 years of experience in handling and transporting dry bulk materials. r. Hulette worked on major coal terminal projects on the East Coast and Great Lakes, where he was also involved in major terminal design projects for iron ore. He has worked on bauxite facilities in Texas and

iron ore projects in Australia. In many studies performed for port authorities, he also examined issues regarding permitting, hazards to the environment (air quality, surface and groundwater contamination, and disturbance of wetlands), and hazards to people.

Geraldine Knatz is Director of Planning for the Port of Long Beach and Project Manager for the Port of Long Beach 2020 Plan and Consolidated Corridor Projects. She received her B.A. in zoology from Rutgers University and her M.S. in environmental engineering and Ph.D. in biological sciences from the University of Southern California. In her current post Dr. Knatz is responsible for the Port's Master Planning, Transportation Planning, Environmental Planning, and Market Research sections. She is also Instructor, Environmental Engineering at the University of Southern California, and Adjunct Professor of Public Administration, California State University, Long Beach. She has authored or coauthored several reports and articles on environmental issues.

James W. McClellan is Director of Corporate Development for Norfolk Southern Corporation. He received his B.S. in transportation engineering from the Wharton School of the University of Pennsylvania and served as an officer of the U.S. Navy. Mr. McClellan began his career in the railroad industry in 1962 when he joined the marketing department of Southern Railway System. He subsequently worked as an Assistant Manager in Marketing for Penn Central. He later worked for the Federal Railroad Administration, Amtrak, and in 1974 he became the Assistant Vice-President, Strategic Planning, of the U.S. Railway Association. From there he moved to the Association of American Railroads as a policy analyst in 1976 and subsequently joined the Corporate Development Department of Norfolk Southern in 1977.

Craig E. Philip is Senior Vice President and Chief Commercial Officer of Ingram Barge Company of Nashville, Tennessee. He received his B.S.C.E. from Princeton and his M.S. and Ph.D. in engineering and management from the Massachusetts Institute of Technology. From 1987 to 1991 Dr. Philip was Vice-President, Intermodal Division, of the Southern Pacific Transportation Company. Formerly he had been Vice-President, Marketing, with Ingram Barge Company. Before joining Ingram, he worked at Conrail, the Regional Science Research Institute, and the Association of American Railroads and taught courses at MIT, Vanderbilt, and Princeton. He has published several articles on waterway and railroad productivity. Dr. Philip is active in several professional and transportation associations.

Clyde E. Pyers is Director, Office of Transportation Planning, Maryland Department of Transportation. He received his B.S. in civil engineering from Ohio University in Athens. He pursued graduate studies in city and regional planning at the University of California at Berkeley. He worked as a planner for the U.S. Bureau of Public Roads from 1959 to 1965, then worked as a technical director for the Cleveland–Seven County regional planning group. He served as a planning consultant with Wayne State University from 1969 to 1971, at which time he joined the Maryland Department of Transportation. He has been Director, Office of Transportation Planning since 1971. Both at M-DOT and in his involvement with the American Association of State Highway and Transportation Officials, Mr. Pyers has been involved in planning transportation systems at the state and national level. He has served on the Group 1 Council of the Transportation Research Board, has been involved in several AASHTO committees, and is active in the American Society of Civil Engineers and the American Public Works Association.

William M. Rohe is Professor of City and Regional Planning, Department of City and Regional Planning, University of North Carolina, Chapel Hill. Dr. Rohe received a double B.A. in psychology and sociology from the State University of New York at Buffalo. He received his M.S. in man-environment relations, his M.R.P in regional planning, and his Ph.D. in man-environment relations from Pennsylvania State University. Dr. Rohe joined the faculty of the Department of City and Regional Planning at the University of North Carolina, Chapel Hill, in 1978. He has published many articles on the role of urban neighborhoods in urban planning and the effects of land use, housing, and transportation policies on local communities. He is co-author of *Planning with Neighborhoods*, University of North Carolina Press (1985). Dr. Rohe is active in the American Planning Association.

Peter L. Shaw is Professor of Public Policy and Administration and Head of the Transportation Policy and Planning Program, California State University Long Beach (CSULB). Dr. Shaw received his B.A. from Occidental College, his M.P.A. from New York University, and his Ph.D. in urban planning and public administration from New York University. Dr. Shaw has held management and planning positions with the City of New York, U.S. Department of Transportation, and the Southern California Association of Governments (SCAG). AT CSULB he has studied urban transportation, the role of transportation in port productivity, and local transportation policy. He has written articles in transportation journals and DOT and University of California publications. He is active in

the Transportation Research Board, the Los Angeles–Long Beach Propeller Club, American Society for Public Administration, Western Governmental Research Association, and the Advisory Committees of the Los Angeles County Transportation Commission and SCAG.

Wayne K. Talley is former Chairman of the Department of Economics, Old Dominion University. He received his B.A. in economics from the University of Richmond and his M.A. and Ph.D. from the University of Kentucky. He joined the faculty at Old Dominion in 1972 as an Assistant Professor and is currently an Eminent Scholar. Dr. Talley has written many articles on urban transportation, transport costing, maritime transportation, transport pricing, air, highway and intercity bus transportation, public finance, and economic statistics. Among his contributions to several books, he is a co-author of *Ocean Container Transportation: An Operational Perspective* (1990). Dr. Talley is active in the Transportation Research Board and the Transportation Research Forum; he is a referee for six journals.

James P. Toohey is Assistant Secretary of Transportation for Transit, Research, and Intermodal Planning of the Washington State Department of Transportation. Mr. Toohey graduated from the University of Massachusetts. Before joining the Washington DOT, he spent several years as a consultant for a major accounting firm. Before becoming Assistant Secretary in 1984, he was responsible for the department's management and financial planning, productivity efforts and liaison with legislative, constituent, and private sector groups. He is a member of TRB's technical committee on Statewide Multimodal Transportation Planning and is also active in the American Association of State Highway and Transportation Officials, the American Public Transit Association, the Washington State Transit Association, and the Women's Transportation Seminar.

M. John Vickerman, Jr., is co-founder and President of Vickerman-Zachary-Miller, an engineering and architectural design firm that specializes in planning and designing port intermodal facilities. Mr. Vickerman received his B.S. in architectural engineering from California Polytechnic State University and his M.S. in structural engineering from the University of California at Berkeley. Mr. Vickerman has provided engineering design services to most of the major ports throughout the United States. He has written many papers on marine terminal design and intermodal transportation. Mr. Vickerman is also a member of the Transportation Research Board Committee for the Conference on Intermodal Planning Issues and is Chairman of the Committee on Intermodal Freight Terminal Design and Operations.

The Transportation Research Board is a unit of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board's purpose is to stimulate research concerning the nature and performance of transportation systems, to disseminate the information produced by the research, and to encourage the application of appropriate research findings. The Board's program is carried out by more than 300 committees, task forces, and panels composed of more than 3,700 administrators, engineers, social scientists, attorneys, educators, and others concerned with transportation; they serve without compensation. The program is supported by state transportation and highway departments, the modal administrations of the U.S. Department of Tr
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roviding services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both the Academies and the Institute of Medicine. Dr. Frank Press and Dr. Robert M. White are chairman and vice chairman, respectively, of the National Research Council.